New York City Transit

SYSTEM-WIDE PLATFORM SCREEN DOOR FEASIBILITY STUDY

SUMMARY OF CONCLUSIONS

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225 Park Avenue South
New York

SYSTEM-WIDE PLATFORM SCREEN DOOR FEASIBILITY STUDY – SUMMARY OF CONCLUSIONS

Background: Platform Screen Doors (PSDs), including all types of platform barrier systems, create a barrier between the trackway and passengers on the edge of platforms to reduce incidents of people coming into contact with trains. An investigation of this technology for use in the New York City Subway system was requested by NYCT.

Starting in October 2014, NYCT retained STV to follow up on earlier NYCT initiatives to improve customers' platform safety. STV was asked to begin a comprehensive background study which concluded in September 2016. The report provided NYCT with a greater understanding of the requirements for installing, operating, and maintaining various types of barrier systems including the control and communications systems new to NYCT that such technologies require. It became clear that installation of any of these systems would touch every division in NYCT.

Types of barrier systems in use by various transit agencies worldwide are:

1. Platform Screen Doors (PSD): full height
2. Automatic Platform Gates (APG): half height
3. Rope Platform Screen Doors (RPSD): vertically opening gate system

STV was tasked with a System-wide PSD Feasibility Study that was to address the challenges unique to the New York Subway system. Based upon the previous comprehensive background PSD study, continued discussions with NYCT, and conditions discovered during field surveys STV identified the challenges to installing PSDs in New York's century-old subway system. These challenges include but are not limited to:

- Platform width
- Distance of obstructions from platform edge (primarily staircases and columns)
- Americans with Disabilities Act (ADA) requirements
- Room/space availability for placement of door control equipment
- Availability of power to accommodate additional electrical load
- Multiple car classes with varying door opening positions
- Gaps between platform edges and trains
- Structural integrity of platform edges to support additional weight of PSDs
- Air flow dynamics within the station
- Other challenges included limited height, moving platform edges, grounding / isolation issues, etc.

Feasibility Study Scope and Schedule: In March 2017 STV began the study of all 472 subway stations to determine the feasibility of installing fixed railings, PSDs, APGs, and/or RPSDs at each station (nominally 472 stations) and every platform (more than 1200 platform edges). Working with NYCT, STV employed a hierarchical approach to assess the feasibility of installing the various barrier technologies via the development of screening criteria that defined 'fatal flaws' and/or critical cost factors. This hierarchical approach began with the broadest issues (for example, consistent train-door-alignment to train-door-alignment at platforms that share Lines), to less broad issues (for example, establishment of minimum space requirements for PSD control rooms or minimum clear space for APG/PSD components at the platform edge while maintaining code/ADA compliant egress widths) and to station specific issues (for example, the applications of these minimum space requirements at each station and platform). STV developed the screening criteria with NYCT project leadership, reviewed them with relevant stakeholders, and issued them shortly after the commencement of the study in a series of white papers.

Fixed railings were eliminated early in the study due to expressed concerns by NYCT OSS and MOW regarding the potential injury they could cause to customers due to door dragging incidents. RPSDs were also assessed and removed due to their very limited application world-wide, boarding and alighting issues, and other hazards they posed to customers.

Working with multiple survey teams, STV wrote reports for each station describing the application of the criteria. Where stations were deemed feasible, rough order of magnitude cost estimates were developed and included with the reports. Infeasible stations were documented as well, highlighting the reasons for infeasibility. Reports for each service line were issued together.

At the start of the study in March 2017, a schedule duration of 39 months was established with a completion date of June 2020; however, STV made significant efforts to expedite the completion of the study. Consequently, STV was able to complete the study in August 2019, 10 months ahead of schedule, following the issuance of the 22nd and final feasibility report.

Feasibility Results: Currently the NYCT Subway system features cars with three different door alignment profiles on the A Division and three on the B Division. The car types in each division are mixed among Subway Lines within their respective Divisions. The different spacing of doors on these cars makes installation of platform doors infeasible at most stations today. However, NYCT plans to complete the procurement of new rolling stock, per division, with nearly identical car geometries/door spacing, by 2033. Accordingly, STV's assessment assumes homogenized car classes, per division, by the year 2033.

PSD were deemed feasible at as few as **3%** and as many as **75%** of stations on a given Line. Overall system-wide feasibility is **27**%, or **128** of the **472** stations studied. Today, due to door misalignments, PSDs could only be implemented at 41 of the 128 stations, with implementation for the remainder being possible as car types (geometries/door spacings) in each Division/Line get progressively compatible by year 2033. The summary causes of infeasibility of stations are broken down in the table below:

REASONS FOR INFEASIBILITY		
Causative Factors	**Number of Infeasible Stations***	**Percentage of Infeasible Stations**
ADA Clearance	154	43%
Structural integrity of elevated Pre-cast Platforms	100	28%
Fleet Misalignment**	31	9%
Columns too close to edge	30	8%
No Space for PSD Equipment Room	21	6%
Gap Fillers	1	<1%

Above figures are for the year 2033 assuming procurement of new rolling stock occurs as currently scheduled.

*Some of the stations serving multiple Subway Lines may be feasible for one or more Lines but not all (on one or more platforms), therefore aggregating station counts for feasible and infeasible will exceed 472

**Car class compatibility will not be achieved on certain lines regardless of rolling stock changes due to dimensional differences between 8-car (M & G trains) and 10-car trains

Table 1 shows the total rough order of magnitude (ROM) costs including design, construction, Transit Authority Labor and Engineering Force Account costs for the **128** stations found feasible for installation of PSDs/APGs, as discussed above. The PDS (full height) option totals **$7.01B** and the APG (half height) option totals **$6.53B**, with approximate cumulative annual maintenance costs of **$119.16M** for either.

Table 1 – Total Approximate System-Wide Costs

No. of Stations	No. of Feasible Stations	% Feasibility	OPTION 1:* PSD (full height): Total Cost ($ billion)	OPTION 2:* APG (half height): Total Cost ($ billion)	Annual Maintenance Cost ($ million)
472	**128**	**27%**	**$7.01**	**$6.53**	**$119.16**

Table 2 (next page) shows the ROM cumulative loaded design, construction, NYCT Labor and Engineering Force Account costs for stations found feasible for installation of PSDs/APGs by Subway Lines/Service Routes. The cost for each Subway Line/Service Route includes duplicate costs that appear in a related Subway Line/Service Route that shares stations (for example, the Nos. 1, 2, & 3 routes). All cost estimates are based on 2018-19 dollars. Escalation costs out to possible year of award are not included and are expected to be around 4% per annum.

Table 2 – Approximate Costs Per Line						
Line/Service	**No. of Stations****	**No. Feasible**	**% Feasibility**	**OPTION 1*: PSD (full height) Total Cost ($ million)**	**OPTION 2*: APG (half height) Total Cost ($ million)**	**Annual Maintenance Cost ($ million)**
S (T. Sq.)	2	1	50.0%	$31.41	$27.23	$0.93
L	24	14	58.3%	$764.84	$605.43	$13.03
7	22	7	31.8%	$491.94	$445.86	$6.52
F	45	5	11.1%	$318.17	$250.72	$4.66
G	21	6	28.6%	$377.45	$288.83	$5.59
E	32	12	37.5%	$793.80	$614.28	$11.17
J Z	30	6	20.0%	$366.81	$267.83	$5.59
M	36	4	11.1%	$218.88	$175.58	$3.72
W	23	3	13.0%	$131.58	$153.50	$2.79
N	46	9	19.6%	$572.57	$501.93	$8.38
R	45	3	6.7%	$259.67	$201.95	$2.79
1	38	6	15.8%	$323.92	$258.36	$5.59
2	61	5	8.2%	$267.56	$213.61	$4.66
3	34	1	2.9%	$52.37	$42.32	$0.93
4	54	5	9.3%	$268.63	$215.21	$4.66
5	55	6	10.9%	$311.12	$257.47	$5.59
6	38	5	13.2%	$271.33	$215.16	$4.66
Q	34	8	23.5%	$443.67	$449.52	$7.45
S (Fkln. Ave.)	4	3	75.0%	$65.00	$58.12	$2.79
A /C	66	41	62.1%	$2,637.00	$2,214.32	$38.17
B	37	6	16.2%	$447.30	$349.21	$5.59
D	41	5	12.2%	$320.52	$250.59	$4.66

* Loaded estimated cost includes design, construction (+ 5% contingency), (+ 20% Engineering Force Account) & (+30% Transit Authority Labor)

** Some of the stations serving multiple subway lines may be feasible for one or more lines (on one or more platforms) but not necessarily all lines or platforms. Therefore, aggregating feasible and infeasible station counts will exceed 472 stations and overall cost totals from Table 2 will be more than the totals shown in Table 1.

New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR ‘1’ SERVICE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

FINAL SUBMITTAL DATE: February 22, 2019

STV 100 Years

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Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. Our Tier 1 analysis found no instances of door misalignment between car classes for this line. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 38 newly evaluated stations, 32 have been found to be not suitable for the installation of PSDs.

[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to half-height barriers]

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues; the platform edge barriers are 15" wide. Where an existing object (wall, stair, and railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Under the following conditions, PSDs are declared infeasible:
  - Limit the ability of a wheelchair to turn within a 5'-0" circle
  - Limit path of travel to less than a 32" pinch width (defined as an obstruction that measures less than 2'-0" longitudinally, i.e. columns)
  - Limit path of travel to be less than a 36" corridor as defined by the edge of a staircase, railing or room
- Insufficient space for the PSD equipment room; the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow; due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements regarding the placement of these new barriers in an existing station environment.
- Structural considerations; existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.

- Columns at platform edge: at certain stations, the columns are positioned 16" to 24" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space.

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the previously proposed 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the PSD barriers and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is used for refuse removal at the 1-line stations. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the (off) loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in damage from these carts along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 16% of the '1' Line stations. Total implementation cost would be \$164.0M for APGs and \$205.7M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; that estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of \$931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 6 feasible stations, the aggregate annual maintenance cost would be \$5.6M.

Summary Table

(16% Feasible 6/ 38)

MR No.	Station Names	Sta. Type	Platform Type	Feasibility	Issues/Reason for Failure	Cost APGs	Cost PSDs
293	242nd Street Van Cortlandt Pk	ELV		No	Precast Platform	-	-
294	238th Street	ELV		No	Precast Platform	-	-
295	231st Street	ELV		No	Precast Platform	-	-
296	225th Street Marble Hill	ELV		No	Precast Platform	-	-
297	215th Street 10th Ave	ELV		No	Precast Platform	-	-
298	207th Street	ELV		No	Precast Platform	-	-
299	Dyckman Street Nagle Ave.	ELV		Yes	-	27.4M	34.0M
300	191st Street	SUB		Yes	-	27.1M	33.6M
301	181st Street	SUB		No	ADA Clearance	-	-
302	168th Street	SUB		No	ADA Clearance	-	-
303	157th Street	SUB		No	Columns at platform edge	-	-
304	145th Street	SUB		No	Columns at platform edge	-	-
305	137th Street City College	SUB		No	Columns at platform edge	-	-
306	125th Street	ELV		No	Precast Platform	-	-
307	116th Street	SUB		No	Columns at platform edge	-	-
308	110th Street Cathedral Pkwy	SUB		No	Columns at platform edge	-	-
309	103rd Street	SUB		No	Columns at platform edge	-	-
310	96th Street West End Ave	SUB		No	ADA Clearance	-	-
311	86th St.	SUB		No	Columns at platform edge	-	-
312	79th Street	SUB		No	Columns at platform edge	-	-
313	72nd Street	SUB		No	ADA Clearance	-	-
314	66th Street Lincoln Center	SUB		No	Columns at platform edge	-	-
315	59th Street Columbus Circle	SUB		No	Columns at platform edge	-	-
316	50th Street	SUB		No	Columns at platform edge	-	-
317	42nd St. Times Square	SUB		No	ADA Clearance	-	-
318	34th Street Penn Station	SUB		No	ADA Clearance	-	-
319	28th Street	SUB		No	ADA Clearance	-	-
320	23rd Street	SUB		No	ADA Clearance	-	-
321	18th Street	SUB		No	ADA Clearance	-	-
322	14th Street	SUB		No	ADA Clearance	-	-
323	Christopher Street Sheridan Sq.	SUB		No	No PSD Room Location	-	-
324	Houston Street Varick St.	SUB		Yes	-	27.2M	34.2M
325	Canal Street	SUB		Yes	-	27.6M	35.3M
326	Franklin Street	SUB		Yes	-	27.1M	33.7M
327	Chambers St. West Bway	SUB		No	ADA Clearance	-	-
328	Cortlandt St. WTC	SUB		Yes	-	27.6M	34.8M
329	Rector Street	SUB		No	No PSD Room Location	-	-
330	South Ferry Whitehall St. Ferry	SUB		No	No PSD Room Location	-	-
					Total	**164.0M**	**205.7M**

1.0 Station Assessments

1.01 – MR 293 | 242nd Street / Van Cortlandt Park Station

Summary: *242nd Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

242nd Street Station is an elevated station consisting of a center / island platform and two side platforms that are not in use. The platform structure is precast concrete. The width of the center platform is 14'-0" throughout. The platform is straight with one row of centered columns supporting the station canopy. See figure 1 & 2 for reference.

***Figure 1** – General Station Condition*
242nd Street Station

***Figure 2** – Precast Slabs*
242nd Street Station

1.02 – MR 294 | 238th Street Station

Summary: *238th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The 238th Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 8'-3" to 14'-0". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

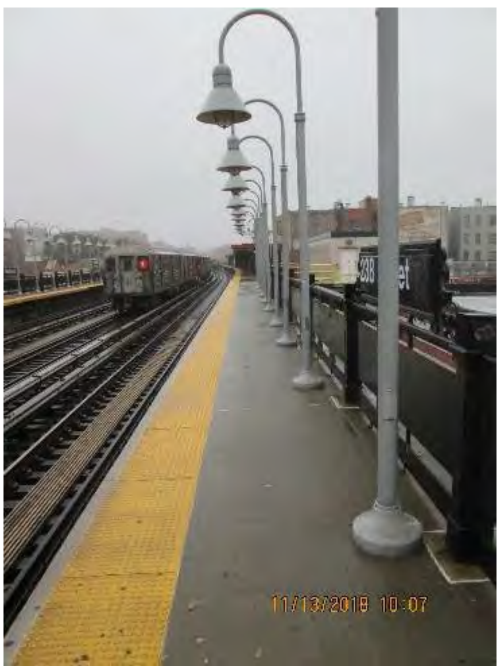

Figure 1 *– General Station Condition*
238th Street Station

Figure 2 *– Precast Slab*
238th Street Station

1.03 – MR 295 | 231st Street Station

Summary: *231st Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

231st Street Station is an elevated station with two straight side platforms. The platform structures are precast concrete. The width of the platforms is approximately 14'-6", narrowing to 8'-0" at the ends. The platforms are straight with a single row of columns supporting their respective station canopies. See figure 1 & 2 for reference.

Figure 1 *– Overall view*
231st Street Station

Figure 2 *– Precast concrete platforms*
231st Street Station

1.04 – MR 296 | 225th Street Station

Summary: *225th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

225th Street Station is an elevated station with two straight side platforms. The platform structures are precast concrete. The width of the platforms is approximately 14'-8", narrowing to 7'-0" at the ends. The platforms are straight with a single row of columns supporting their respective station canopies. See figure 1 & 2 for reference.

Figure 1 *– Overall view*
225th Street Station

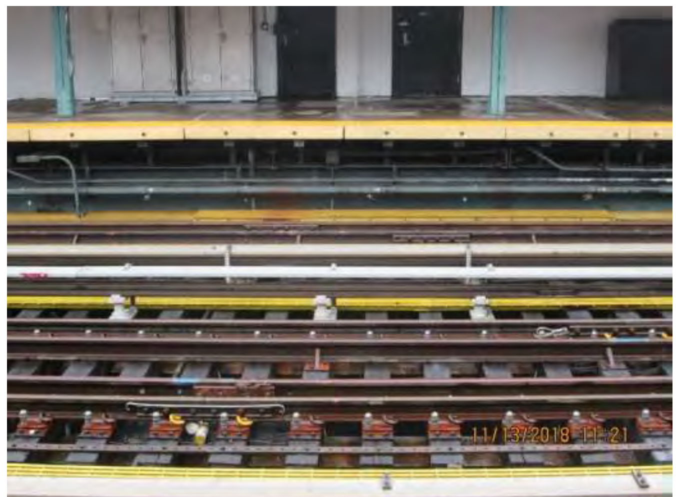

Figure 2 *– Precast concrete platforms*
225th Street Station

1.05 – MR 297 | 215th Street Station

Summary: *215th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

215th Street Station is an elevated station with two straight side platforms. The platform structures are precast concrete. The width of the platforms is approximately 14'-0", narrowing to 7'-0" at the ends. The platforms are straight with a single row of columns supporting their respective station canopies. See figure 1 & 2 for reference.

Figure 1 *– Overall view*
215th Street Station

Figure 2 *– Precast concrete platforms*
215th Street Station

1.06 – MR 298 | 207th Street Station

Summary: *207th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

207th Street Station is an elevated station with two straight side platforms. The platform structures are precast concrete. The width of the platforms is approximately 14'-0", narrowing to 7'-0" at the ends. The platforms are straight with a single row of columns supporting their respective station canopies. See figure 1 & 2 for reference.

***Figure 1** – Overall view*
207th Street Station

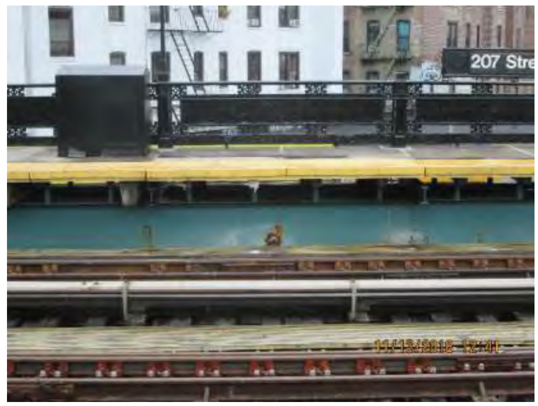

***Figure 2** – Precast concrete platforms*
207th Street Station

1.07 – MR 299 | Dyckman Street Station

Summary: *Dyckman Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Dyckman Street Station is an elevated / on-grade station with two side platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are located along approximately one-third of the platforms at the canopy. Column faces measure approximately 4'-2" from the platform edge. The platform width is approximately 13'-0" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located on the southbound platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-0" x 7'-0".

Track Layout

Tracks are nearly tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the last five years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would only be required for the installation of an APG system.

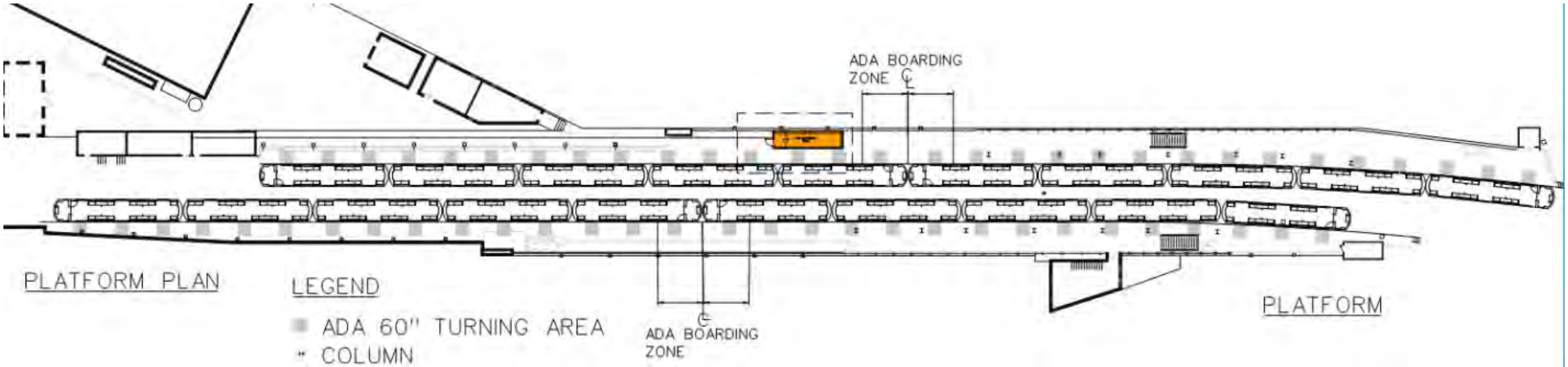

Figure 1 *– Overall Station Plan*
Dyckman Street Station

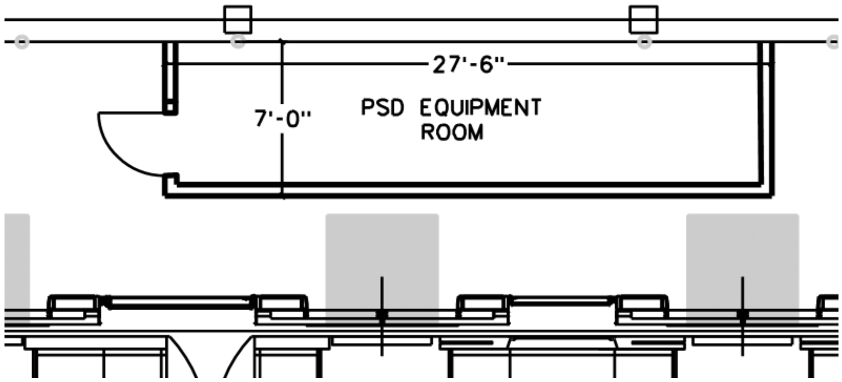

Figure 2 *– PSD Equipment Room 1 Detail*
Dyckman Street Station

Figure 3 *– Typical platform view*
Dyckman Street Station

Platform obstructions within 5' of edge:

- Northbound: Columns
- Southbound: Columns

These obstructions do not present an impediment to the installation of PSDs.

Lighting:
Existing lighting: At the platform canopies there are linear florescent fixtures mounted parallel to the platform edge. Where no canopy exists, lighting is provided by pole-mounted fixtures along the back wall. No lighting reconfiguration will be required as a result of a PSD installation.

Power:
This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 & Table 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (normal service)

Station Name	Dyckman Street Nagle Ave.
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	61.2
Apparent Power (kVA)	76.5
Station Peak Demand Load, Max Current, (A)	213.0
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	371
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	747 (=1200*0.8-213)
Is Electrical Service Adequate?	**Yes**
Notes	Station's current spare capacity is 747A. PSD load is 158 A. Therefore there is spare capacity in Normal Service SW. Similarly, there is spare on Reserve service also since peak deman on Reserve is 46 KW, less that that of Normal load

Table 1. *Normal Service Power Capacity Analysis*

Station
Power Capacity Analysis (reserve service)

Station Name	Dyckman Street Nagle Ave.
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	46.0
Apparent Power (kVA)	57.5
Station Peak Demand Load, Max Current, (A)	160.0
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	318
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	642 (=1200*0.8 - 318)
Is Electrical Service Adequate?	**Yes**
Notes	Spare capacity analysis for Reserve service.

***Table 2**. Reserve Service Power Capacity Analysis*

Historic Restrictions:
The southern end of the Dyckman Street station is a historically designated property. As such, design will require review by the New York State Historic Preservation Office.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.4M to install APGs and $34.0M to install PSDs (See Appendix E)

1.08 – MR 300 | 191st Street Station

Summary: *191st Street is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

191st Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 2'-2" from the platform edge. The southbound platform width is approximately 12'-4" throughout. The northbound platform width is approximately 12'-2 throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting

Equipment Room

The equipment room could be located at the mezzanine flush to the wall (see **Figure 1, Figure 2**). The proposed room dimension is 27'-0" x 7-0".

Track Layout

Tracks are tangent. Therefore, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the last thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would only be required for the installation of an APG system. The 2012 NYCT conditions survey information was not ascertainable at the time of drafting this report, where on a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair. Any platform edge with a rating above 2.5 requires platform rehabilitation regardless of if an APG or PSD system is utilized.

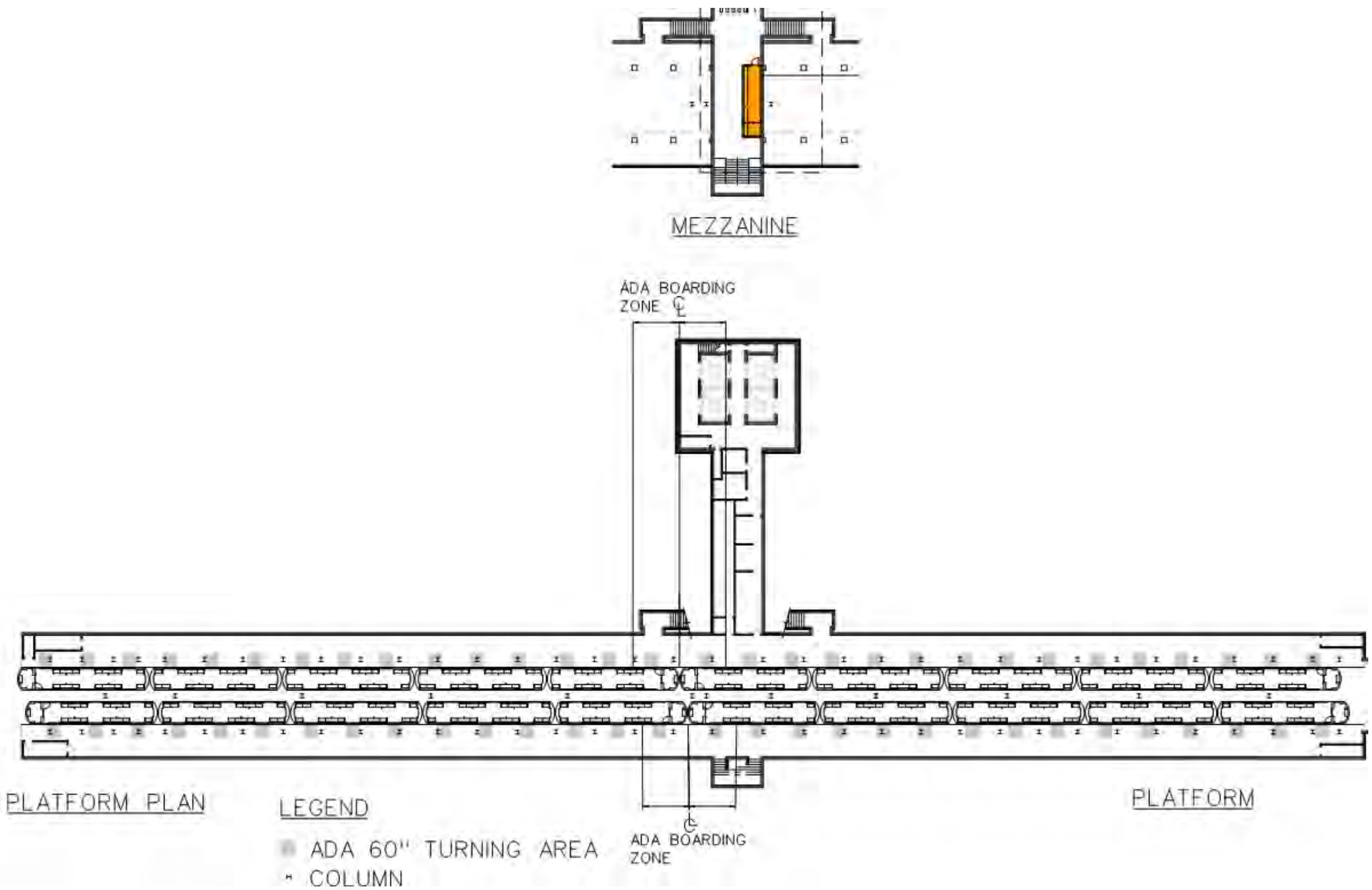

***Figure 1** – Overall Station Plan*
191st Street Station

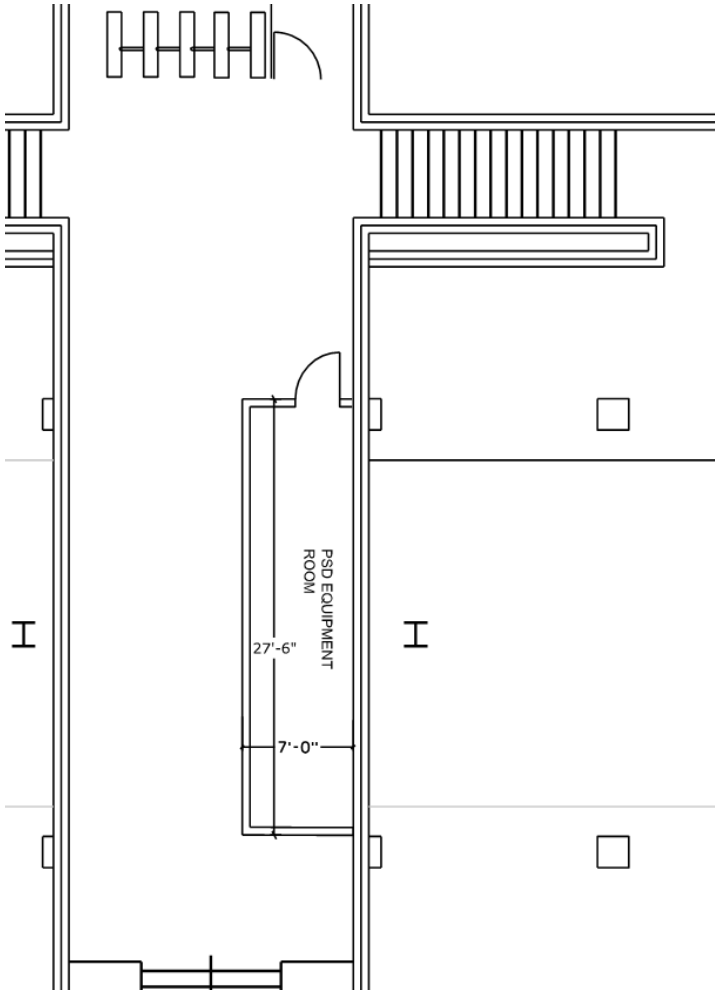

***Figure 2** – PSD Equipment Room Detail*
191st Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge on the inside face of the columns. No lighting re-configuration will be required as a result of a PSD installation.

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Station
Power Capacity Analysis (normal service)

Station Name	191st Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	104.0
Apparent Power (kVA)	130.0
Station Peak Demand Load, Max Current, (A)	361.1
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	519
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200 AF
Service Spare Capacity, (A)	441 (=1200*0.8 - 519)
Is Electrical Service Adequate?	**Yes**
Notes	Service capacity based on Con Ed deman loads & service one line diagram.

Table 1. *Normal Service Power Capacity Analysis*

Station
Power Capacity Analysis (reserve service)

Station Name	191st Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	16.0
Apparent Power (kVA)	20.0
Station Peak Demand Load, Max Current, (A)	56.0
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	214
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	746
Is Electrical Service Adequate?	**Yes**
Notes	Service capacity based on Con Ed deman loads & service one line diagram.

Table 2. Reserve Service Power Capacity Analysis

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions is listed in the attached ROM estimate. The total cost for this station is estimated to be $27.0M to install APGs and $33.6M to install PSDs (See Appendix E)

Figure 3 *– Typical Platform View*
191st Street Station

1.09 – MR 301 | 181st Street Station

***Summary:** 181st Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 33" (see figure 1).*

Description

The 181st Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 12'-10' to 13'-0". The corridor width at this station's staircases is 48". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 33" or less* would not allow for ADA compliant wheelchair movement. Furthermore, there is a column adjacent to the staircase measuring 40" from the platform edge, the implementation of a platform edge barrier would reduce this width to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

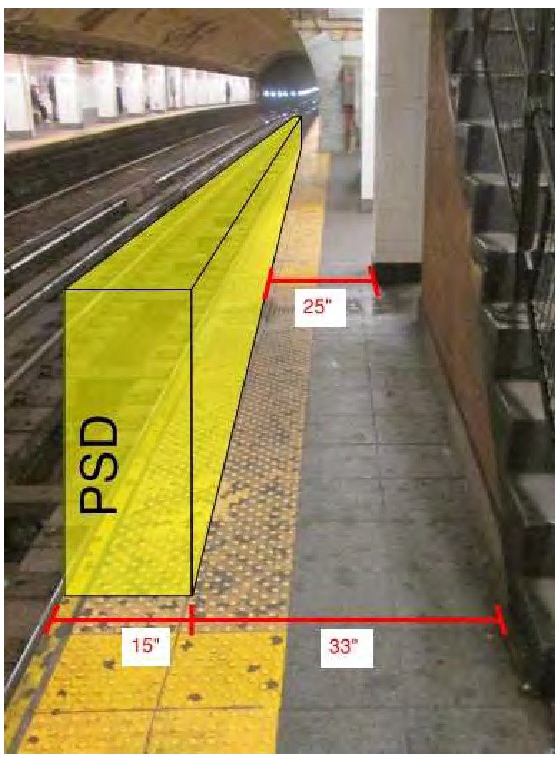

***Figure 1** – Non-compliant ADA condition*
181st Street Station

1.10 – MR 302 | 168th Street Station

Summary: *168th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 15" (see figure 1.*

Description

The 168th Street Station is a below-grade station consisting of two side platforms. The platform widths are approximately 12-6" throughout. The platforms are straight with one rows of columns at 2'-6" from edge of platform. At the south end of the northbound platform, the columns flanking station refuse room are 30" from the platform edge. The implementation of a platform edge barrier would reduce this width to 15" or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

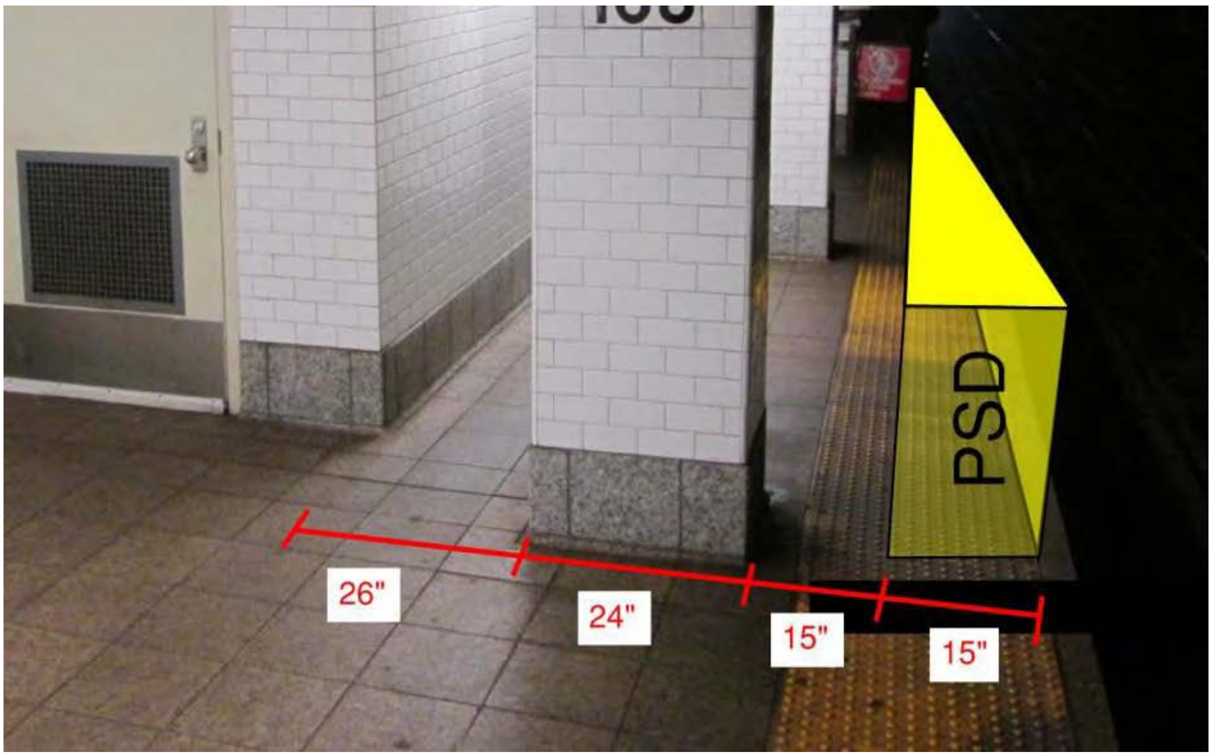

Figure 1 *– Non-compliant ADA condition*
168tht Street Station

1.11 – MR 303 | 157th Street Station

Summary: *157th Street Station is not feasible for both APGs and PSDs as the columns which are located 14" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

157th Street Station is not feasible for both APGs and *PSDs* due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 14" from the platform edge, which would prevent a continuous 15"–wide barrier from being installed. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 1'-2" from the edge*
157th Street Station

1.12 – MR 304 | 145th Street Station

Summary: *145th Street Station is not feasible for both APGs and PSDs as the columns which are located 14" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

145th Street Station is not feasible for both APGs and *PSDs* due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 14" from the platform edge, which would prevent a continuous 15"-wide barrier from being installed. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 1'-2" from the edge*
145th Street Station

1.13 – MR 305 | 137th Street / City College Station

Summary: *137th Street is not feasible for both APGs and PSDs as the columns which are located 14" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

137th Street/City College Station is not feasible for both APGs and *PSDs* due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 14" from the platform edge, which would prevent a continuous 15"-wide barrier from being installed. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 1'-2" from the edge*
137th Street Station

1.14 – MR 306 | 125th Street Station

Summary: *125th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The 125th Street Station is an elevated station with two straight side platforms. The platform structures are precast concrete. There are two staircases at the center of each platform. The platform widths are approximately 12'-8 throughout. The platform is straight with one row of centered columns supporting the station canopy. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
125th Street Station

Figure 2 *– Precast Slab*
125th Street Station

1.15 – MR 307 | 116th Street Station

Summary: *116th Street Station is not feasible for both APGs and PSDs as the columns which are located 12" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

116th Street Station is not feasible for both APGs and *PSDs* due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 12" from the platform edge, which would prevent a continuous 15"-wide barrier from being installed. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 12" from the edge*
116th Street Station

1.16 – MR 308 | 110th Street / Cathedral Parkway Station

Summary: *110th Street Station is not feasible for both APGs and PSDs as the columns which are located 16” from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

110th Street Station is not feasible for both APGs and *PSDs* due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 16” from the platform edge. While this dimension allows for the 15”-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 16" from the edge*
110th Street Station

1.17 – MR 309 | 103rd Street Station

Summary: *103rd Street Station is not feasible for both APGs and PSDs as the columns which are located 12" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

103rd Street Station is not feasible for both APGs and *PSDs* due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 12" from the platform edge, which would prevent a continuous 15"-wide barrier from being installed. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 12" from the edge*
103rd Street

1.18 – MR 310 | 96th Street Station

Summary: *96th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 31" (see figure 1).*

Description

The 96th Street Station is a below-grade station with two straight center/island platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 13'-6' to 17'-8". The corridor width at this station's elevators is 46". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 31" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
96th Street Station

1.19 – MR 311 | 86th Street Station

Summary: *86th Street Station Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

86th Street Station is not feasible for both APGs and *PSDs* due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

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Figure 1 – *Column 16" from the edge*
86th Street Station

1.20 – MR 312 | 79th Street Station

Summary: *79th Street Station is not feasible for both APGs and PSDs as the columns which are located 15" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

79th Street Station is not feasible for both APGs and *PSDs* due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 15" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

***Figure 1 –** Column 16" from the edge*
79th Street Station

1.21 – MR 313 | 72nd Street Station

Summary: *72nd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at five platform stairs as the remaining width would be 15" (see figure 1).*

Description

The 72nd Street Station is a below-grade station with two straight center/island platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 15'-6". The corridor width at this platform stairs is 30". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 15" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-compliant ADA condition*
72nd Street Station

1.22 – MR 314 | 66th Street / Lincoln Center Station

Summary: *66th Street Station is not feasible for both APGs and PSDs as the columns which are located 18" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

66th Street Station is not feasible for both APGs and *PSDs* due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 18" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 18" from the edge*
66th Street Station

1.23 – MR 315 | 59th Street / Columbus Circle Station

Summary: *59th Street Station is not feasible for both APGs and PSDs as the columns which are located 18" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

59th Street Station is not feasible for both APGs and *PSDs* due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 18" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

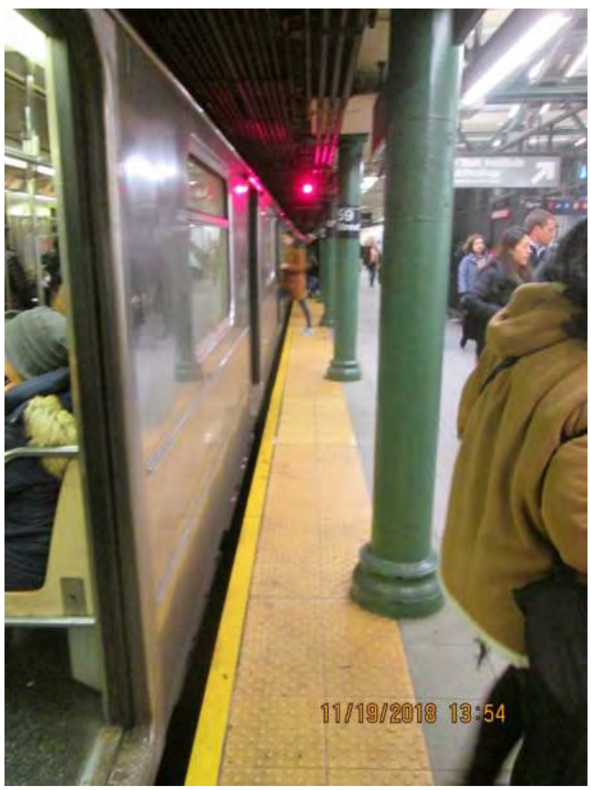

Figure 1 – *Column 18" from the edge*
59th Street Station

1.24 – MR 316 | 50th Street Station

Summary: *50th Street Station is not feasible for both APGs and PSDs as the columns which are located 18" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

50th Street Station is not feasible for both APGs and *PSDs* due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 18" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 18" from the edge*
50th Street Station

1.25 – MR 317 | 42nd Street / Times Square Station

Summary: *42nd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at the south end of the platform as the remaining width would be 27" (see figure 1).*

Description

The 42nd Street Station is an underground station consisting of two center / island platforms. The platforms are approximately 21'-2" wide throughout. At the southern end of the northbound platform there are 42" between the column and the platform edge. The implementation of a platform edge barrier would reduce this width to 27" or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
42nd Street Station

1.26 – MR 318 | 34th Street / Penn Station

Summary: *34th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 27" (see figure 1).*

Description

The 34th Street Station is an underground station consisting one center / island platform. The platforms are approximately 7' wide throughout. At the north end of the northbound platform there is 42" between the column and the platform edge. The implementation of a platform edge barrier would reduce this width to 27" or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
34th Street Station

1.27 – MR 319 | 28th Street Station

Summary: *28th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at south end of the southbound platform as the remaining width would be 33" (see figure 1).*

Description

The 28th Street Station is a below-grade station with two platforms. The platform structures are cast-in-place concrete. The width of the platforms are approximately 11'-10". The implementation of a platform edge barrier would reduce this width at the south end of the southbound platform below the required minimum of 36". The remaining 33" or less* would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

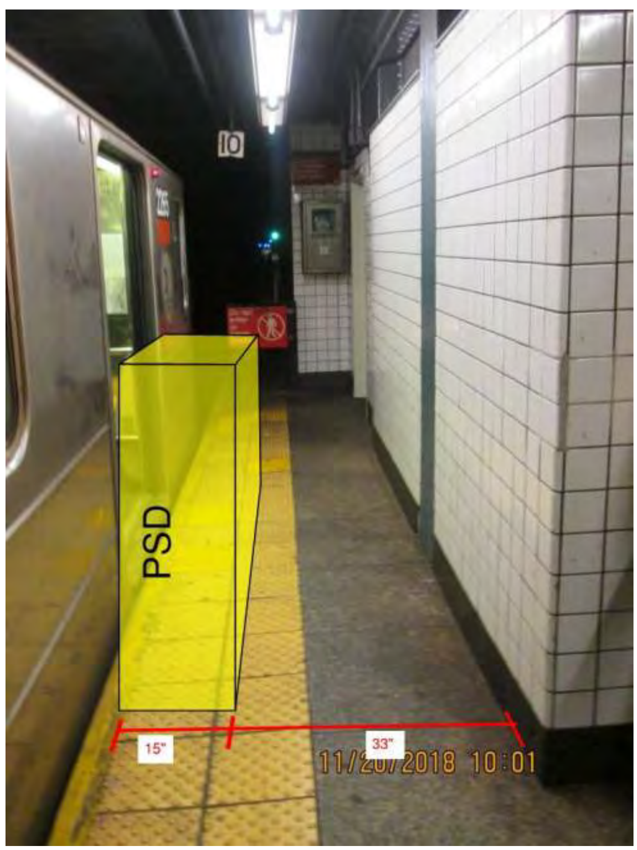

Figure 1 *– Non-Compliant ADA condition*
28th Street Station

1.28 – MR 320 | 23rd Street Station

Summary: *23rd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the northbound platform as the existing width is 5'-10" (see figure 1).*

Description

23rd Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-10' to 11'-10".

Platform width at the ends of the northbound & southbound platform are 5'-10" or 70". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

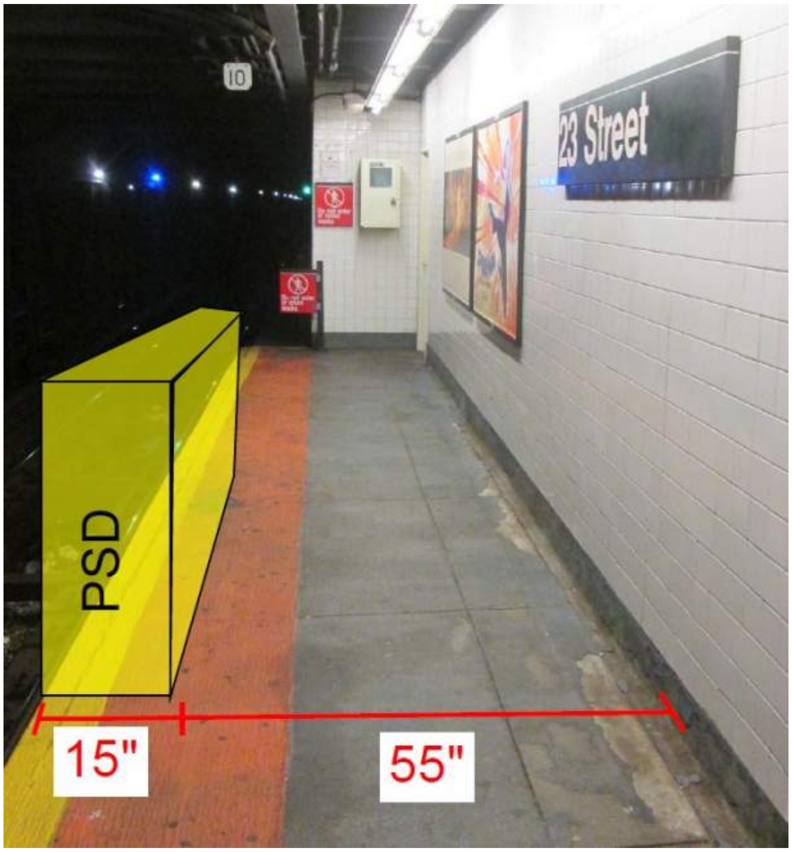

***Figure 1** – Non-Compliant code condition*
23rd Street Station

1.29 – MR 321 | 18th Street Station

Summary: *18th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the southbound platform as the existing width is 5'-0"" (see figure 1).*

Description

18th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-0' to 11'-6".

Platform width at the southern end of the southbound platform is 5'-0" or 60". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant code condition*
18th Street Station

1.30 – MR 322 | 14th Street Station

Summary: *14th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the northbound platform as the existing width is 5'-0"" (see figure 1).*

Description

14th Street Station is a below-grade station with two straight center/ island platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-0' to 19'-4".

Platform width at the southern end of both platforms is 5'-0" or 60". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant code condition*
14th Street Station

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1.31 – MR 323 | Christopher Street Station

Summary: *Christopher Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

Christopher Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns on each platform.

Due to the extremely limited width of the existing platforms, there is no available space for the equipment room. Figure 2 below shows the minimum width required (12'-11") for construction of a PSD equipment room on a station platform. Figure 1, below, demonstrates the lack of available space within the southbound control area. The northbound control area is similar.

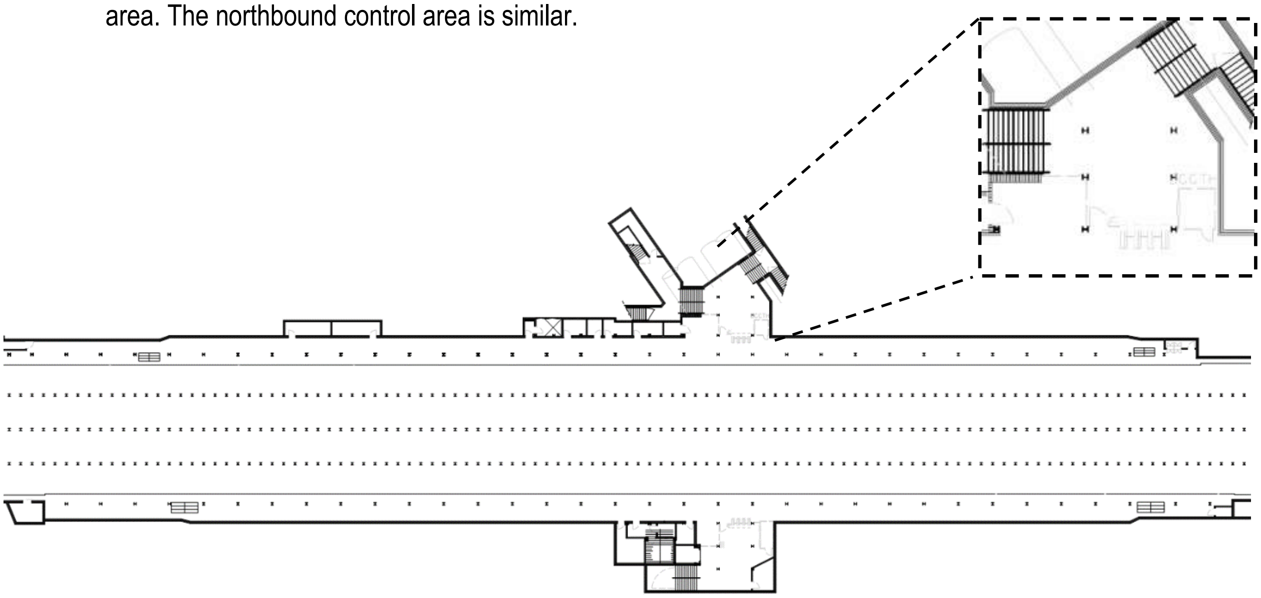


Figure 1 *– Congested/Narrow Station Plan*
Christopher Street Station

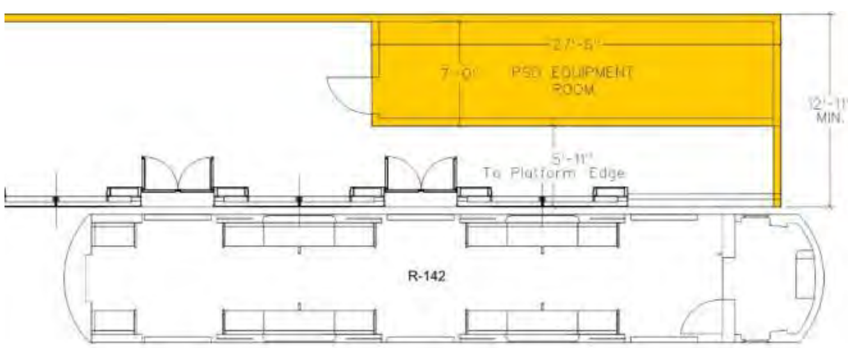


Figure 2 – *Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimension

1.32 – MR 324 | Houston Street Station

Summary: *Houston Street is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Houston Street Station is a below ground station with two side platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are located throughout the length of the platforms along the platform edge. Column faces measure approximately 4'-0" from the platform edge. The platform widths are approximately 12-0" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the southbound control area of the station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed in the early 1990's. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

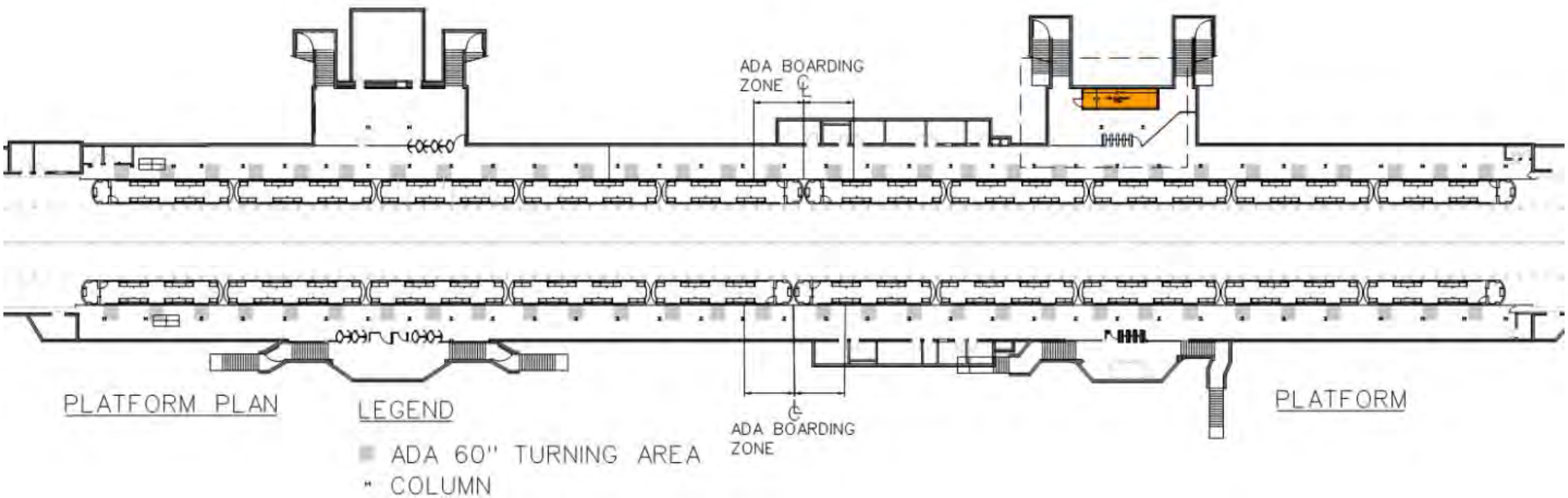


Figure 1 *– Overall Station Plan*
Houston Street Station

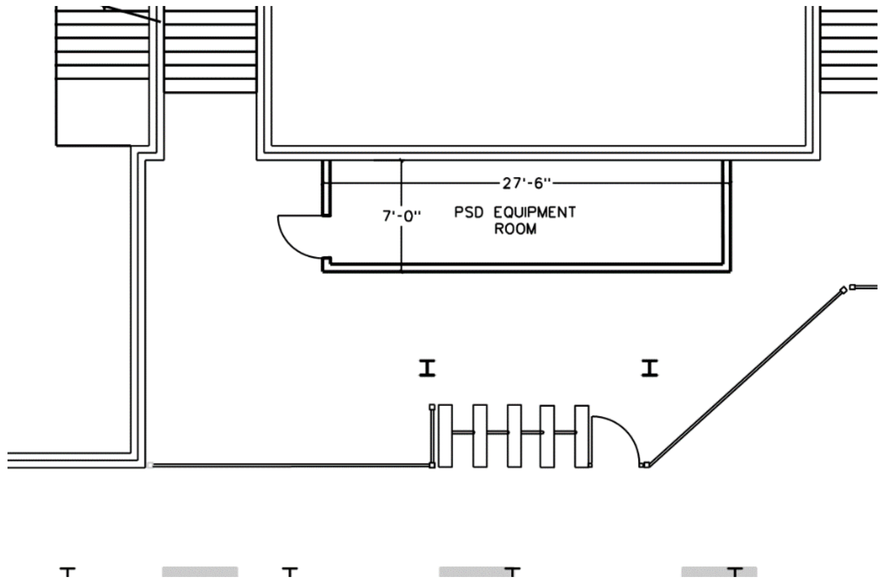


Figure 2 *– PSD Equipment Room 1 Detail*
Houston Street Station

Figure 3 *– Typical platform view*
Houston Street Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:
Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:
This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 & Table 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (normal service)

Station Name	Houston Street Varick St.
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	40.8
Apparent Power (kVA)	51.0
Station Peak Demand Load, Max Current, (A)	141.7
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	299
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	341 (=800*0.8 - 299)
Is Electrical Service Adequate?	**Yes**
Notes	Info based on "Electrical Distribution Room Wiring diagram" and photos.

Table 1. Normal Service Power Capacity Analysis

Station
Power Capacity Analysis (reserve service)

Station Name	Houston Street Varick St.
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	10.4
Apparent Power (kVA)	13.0
Station Peak Demand Load, Max Current, (A)	36.0
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	194
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	446 (=800*0.8 - 194)
Is Electrical Service Adequate?	**Yes**
Notes	Info based on "Electrical Distribution Room Wiring diagram" and photos.

Table 2. Reserve Service Power Capacity Analysis

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.2M to install APGs and $34.2M to install PSDs (See Appendix E)

1.33 – MR 325 | Canal Street Station

Summary: *Canal Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Canal Street Station is a below ground station with two side platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are located throughout the length of the platforms along the platform edge. Column faces measure approximately 4'-0" from the platform edge. The platform widths are approximately 12-0" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the abandoned passageway at the south end of the station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed in the early 1990's. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would only be required for the installation of an APG system. The 2012 NYCT conditions survey information was not ascertainable at the time of drafting this report, where on a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair. Any platform edge with a rating above 2.5 requires platform rehabilitation regardless of if an APG or PSD system is utilized.

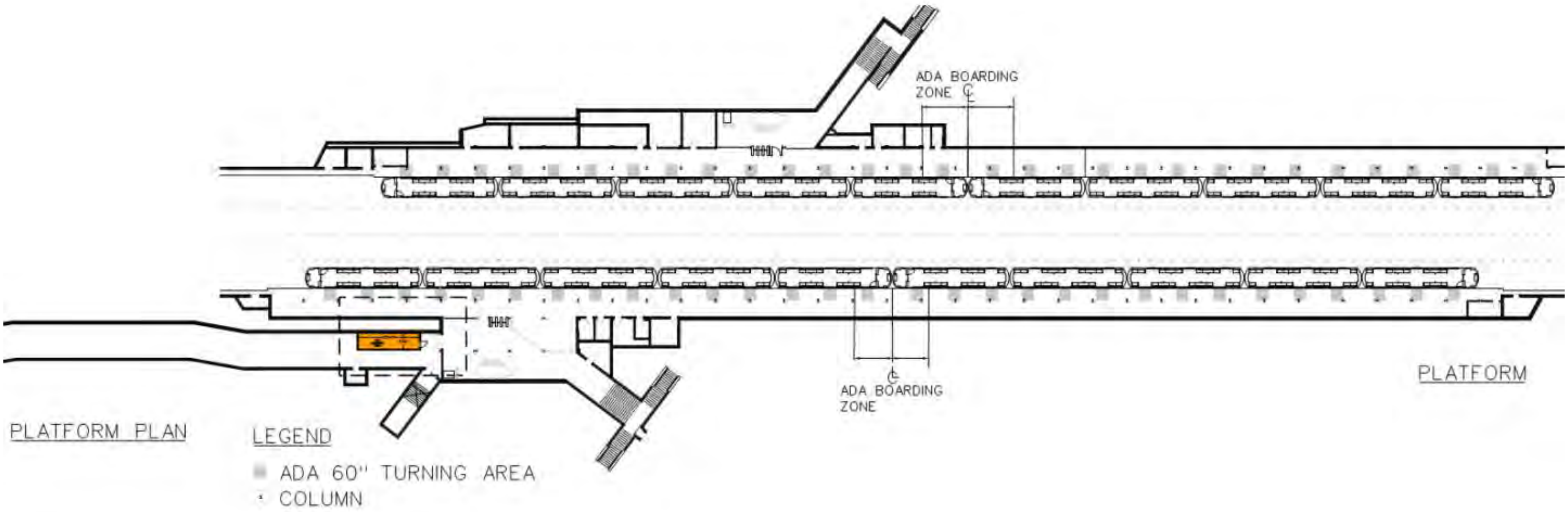


***Figure 1** – Overall Station Plan*
Canal Street Station

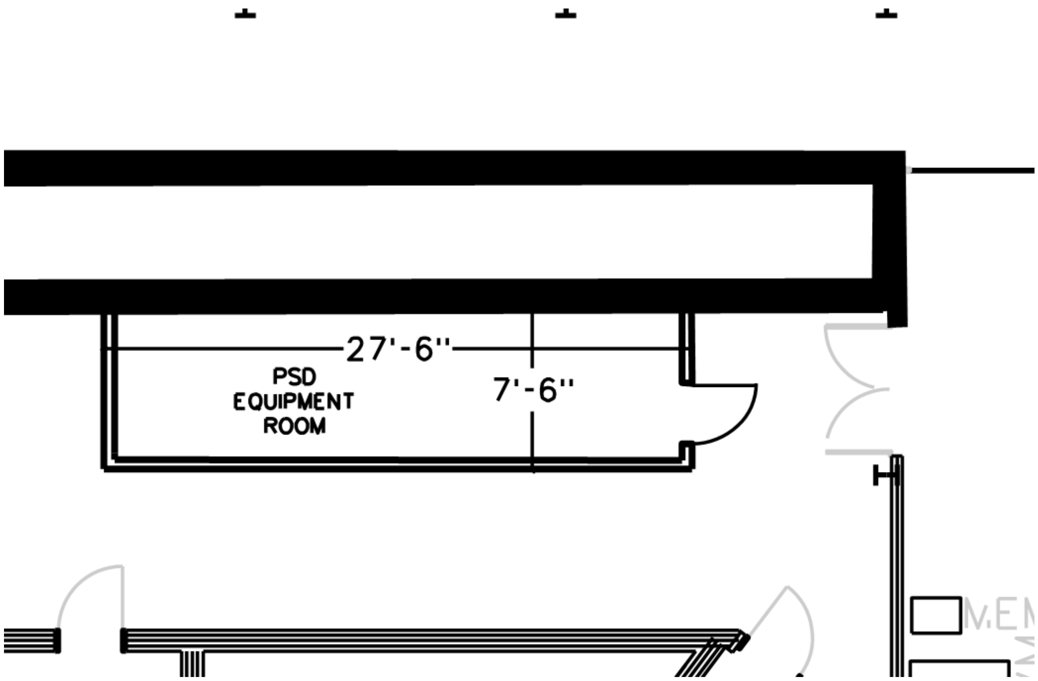


Figure 2 – PSD Equipment Room 1 Detail
Canal Street Station

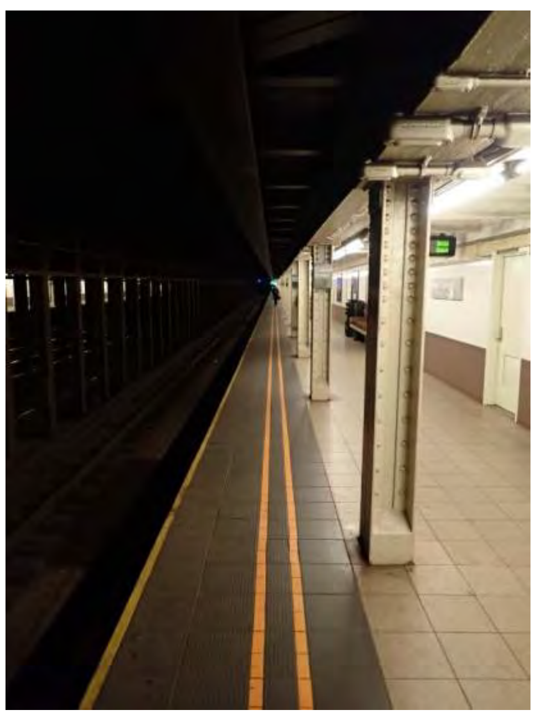


Figure 3 – Typical platform view
Canal Street Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:
Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge on the inside face of the columns. No lighting re-configuration will be required as a result of a PSD installation.

Power:
This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 & Table 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (normal service)

Station Name	Canal Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	0.0
Apparent Power (kVA)	0.0
Station Peak Demand Load, Max Current, (A)	0.0
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	158
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	482 (= 800*0.8 - 158)
Is Electrical Service Adequate?	**Yes**
Notes	Service capacity data is based on photos. Only partial one line diagram (for tunnel lighting) is available. Also the above capacity is based on zero KW demand for Normal power submitted by Con Ed.

***Table 1**. Normal Service Power Capacity Analysis*

Station
Power Capacity Analysis (reserve service)

Station Name	Canal Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	37.2
Apparent Power (kVA)	46.5
Station Peak Demand Load, Max Current, (A)	130.0
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	288
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	352 (= 800*0.8 - 288)
Is Electrical Service Adequate?	**Yes**
Notes	Service capacity data is based on photos. Only partial one line diagram (for tunnel lighting) is available. Also the above capacity is based on demand KW for Reserve power. Normal demand report shows all zeros, suggesting all power has been supplied by Reserve service.

***Table 2**. Reserve Service Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.6M to install APGs and $35.3M to install PSDs (See Appendix E)

1.34 – MR 326 | Franklin Street Station

Summary: *Franklin Street is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Franklin Street Station is a below ground station with two side platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are located throughout the length of the platforms along the platform edge. Column faces measure approximately 4'-0" from the platform edge. The platform widths are approximately 11-4" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the northbound control area of the station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed in the early 1990's. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would only be required for the installation of an APG system. The 2012 NYCT conditions survey information was not ascertainable at the time of drafting this report, where on a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair. Any platform edge with a rating above 2.5 requires platform rehabilitation regardless of if an APG or PSD system is utilized.

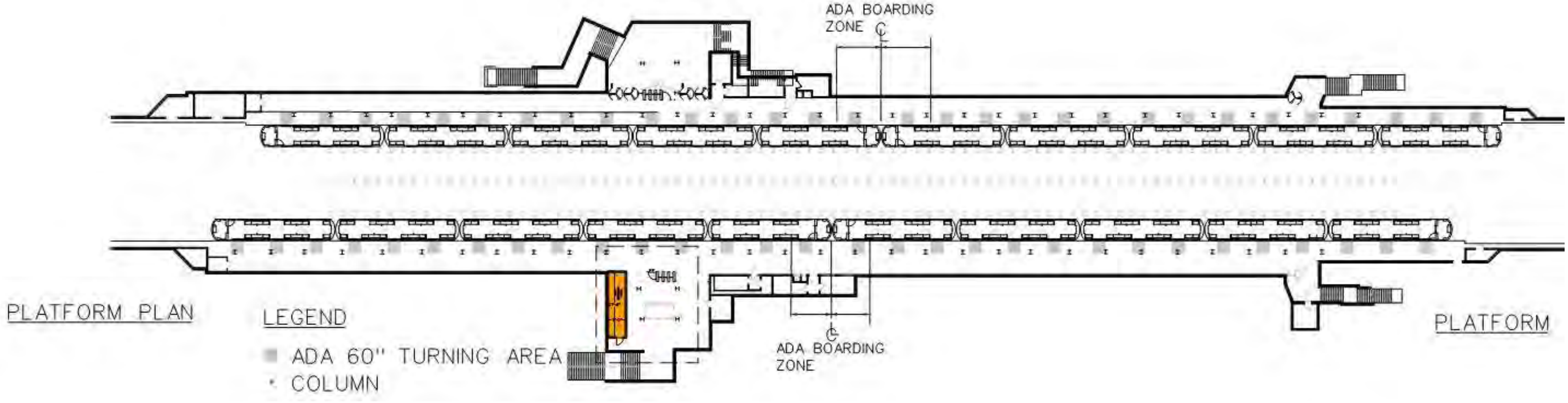


Figure 1 – Overall Station Plan
Franklin Street Station

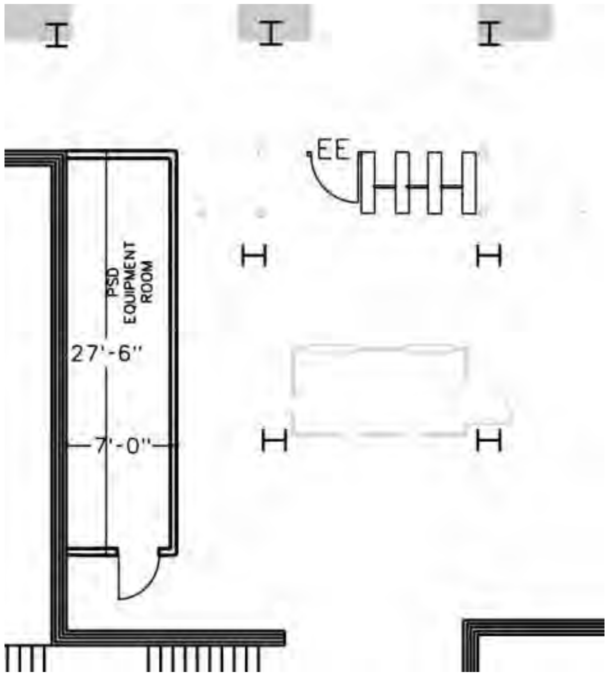


Figure 2 *– PSD Equipment Room 1 Detail*
Franklin Street Station

Figure 3 *– Typical platform view*
Franklin Street Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (normal service)

Station Name	Franklin Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	39.6
Apparent Power (kVA)	49.5
Station Peak Demand Load, Max Current, (A)	137.5
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	296
Station Service Power Capacity, (Main SB or SG Rating), (A)	600
Service Spare Capacity, (A)	184 (=600*0.8 - 296)
Is Electrical Service Adequate?	**Yes**
Notes	Normal demand information available. No reserve service.

***Table 1**. Normal Service Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.1M to install APGs and $33.7M to install PSDs (See Appendix E)

1.35 – MR 327 | Chambers Street Station

Summary: *Chambers Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 15" (see figure 1).*

Description

The Chambers Street Station is a below-grade station with two straight center / island platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 17'-2". The corridor width at the southern end of the southbound platform is 46". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 31" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-compliant ADA condition*
Chambers Street Station

1.36 – MR 328 | Cortlandt Street / WTC Station

Summary: *Cortlandt Street is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Power adequacy could not be ascertained for this station as a history of meter readings was not available for analysis due to the seventeen-year closure of the station. However, a lack of adequate existing power is not considered to be a determining factor of future feasibility.*

Description

Cortlandt Street Station is a below ground station with two side platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are located throughout the length of the platforms along the platform edge. Column faces measure approximately 3'-2" from the platform edge. The platform widths approximately range from 10-4" to 22'-0" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the north end of the southbound platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are nearly tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past five years as part of the station reconstruction project. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would only be required for the installation of an APG system.

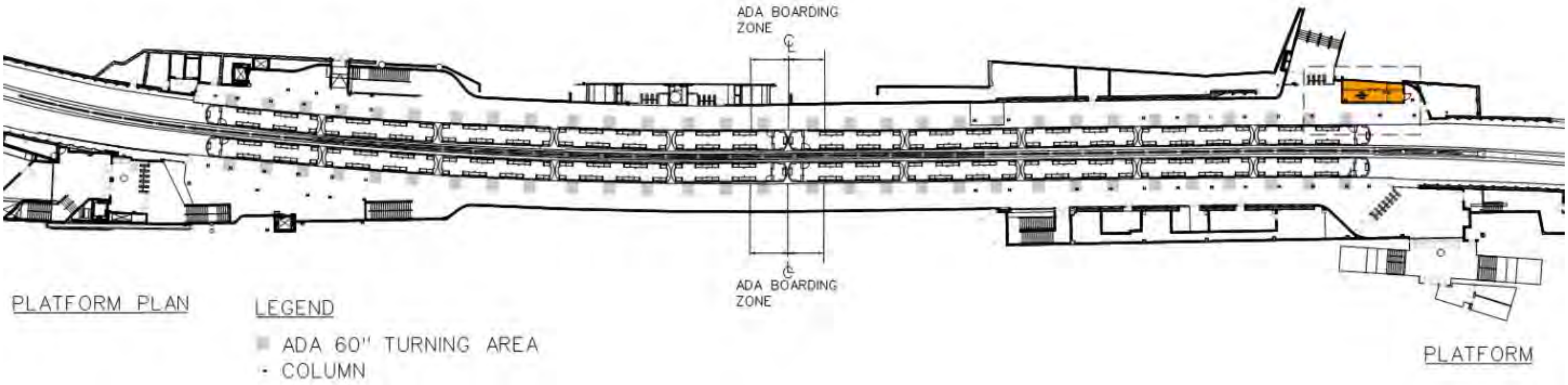


Figure 1 *– Overall Station Plan*
Cortlandt Street Station

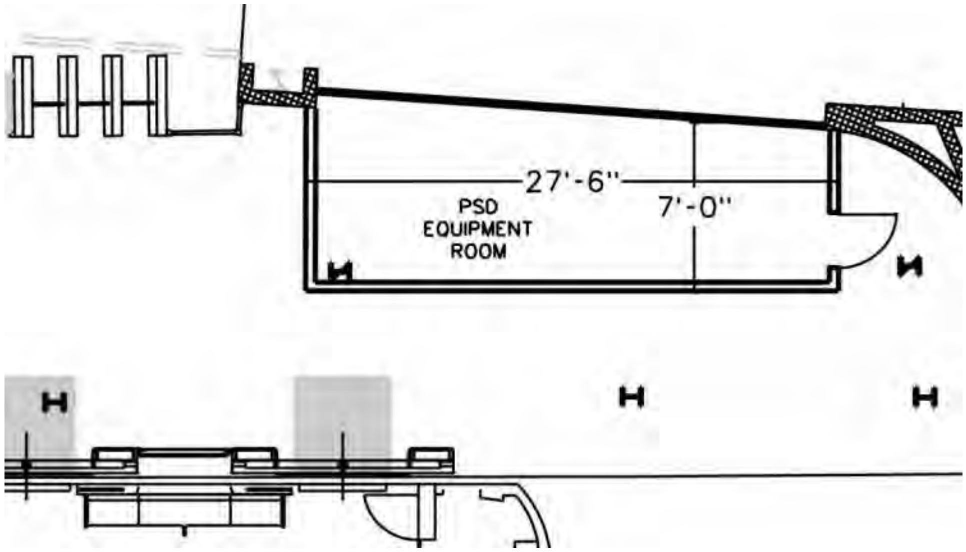


Figure 2 *– PSD Equipment Room 1 Detail*
Cortlandt Street Station

Figure 3 *– Typical platform view*
Cortlandt Street Station

Platform obstructions within 5' of edge:

- Columns at north and south ends of both platforms

These obstructions do not present an impediment to the installation of PSDs.

Lighting:
Existing lighting: Throughout both platforms, linear LED lighting perpendicular to the platform edge. Installation of APG/PSD will not affect the existing lighting configuration.

Power:
A history of meter readings were not available for analysis due to the seventeen-year closure of the station. However, we do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.6M to install APGs and $34.8M to install PSDs (See Appendix E)

1.37 – MR 329 | Rector Street Station

***Summary:** Rector Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room, and due to non-compliant ADA dimensions at the northbound platform.*

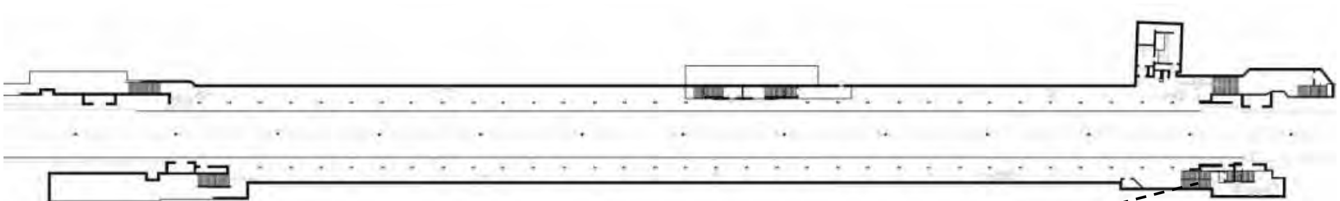
Description

Rector Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns on each platform.

Due to the extremely limited width of the existing platforms, there is no available space for the equipment room. Figure 2 below shows the minimum width required (12'-11") for construction of a PSD equipment room. The width of the existing platform is only 11'-8". Figure 1, below, demonstrates the lack of available space within the northbound control area. The other control areas / exits are similar.

In addition to the above limitation, the installation of PSDs will create constrained dimensions. The width at the northern end of the northbound platform is 38". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 23" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 3 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.



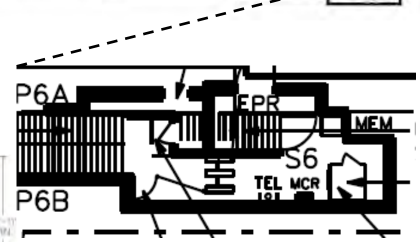


***Figure 1** – Congested/Narrow Station Plan*
Rector Street Station

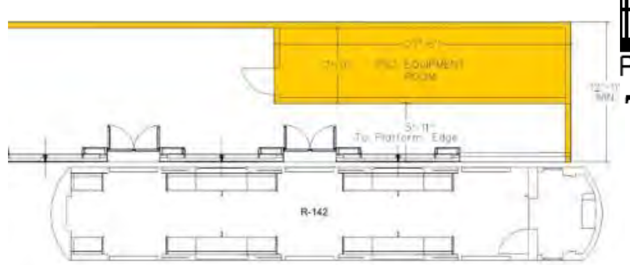


***Figure 2 –** Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimension

Figure 3– *Non-compliant ADA zone at north end of northbound platform*

1.38 – MR 330 | South Ferry Station

Summary: *South Ferry Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the various areas along each platform as the existing width is 4'-8" (see figure 1).*

Description

South Ferry Station is a below-grade station with one center/island platform. The platform structures are cast-in-place concrete. There is a single row of columns at the center of the platform.

Platform width adjacent to various facility rooms on the platform is 4'-8". With the installation of PSDs, this dimension will be reduced to 41" or less*. Our station egress analysis (See Appendix C) finds that 5'-11" is a minimum platform width which will not impede egress via emergency exit doors with an installed PSD system. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains

***Figure 1** – Congested/Narrow Station Plan*
South Ferry Street Station

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for <u>Tier 2 Stations'</u> screening will include the following:*
>
> *a. Column location in relation to the platform edge*
> *b. Platform edge clearance adjacent to stairs and other impediments*
> *c. Impacts to ADA path of travel and boarding areas*
> *d. Conflicts of PSD/APG/RPSDs with Signals cables*
> *e. Sufficient platform width*
> *f. Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for <u>Tier 3 Stations</u> will include the following:*
>
> *a. Structural capacity of platforms to accept PSD/APG/RPSDs*
> *b. Feasibility & location for PSD/APG/RPSDs equipment room*
> *c. Confirmation of adequate power for PSD/APG/RPSDs*
> *d. Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> *e. Determination of communications requirements, availability and cost*
> *f. Determination of gap detection and entrapment avoidance technology requirements*
> *g. Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
    - Double the amount of motors as PSDs (each motor operating a single leaf).
    - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
    - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
    - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	Comments
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

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If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

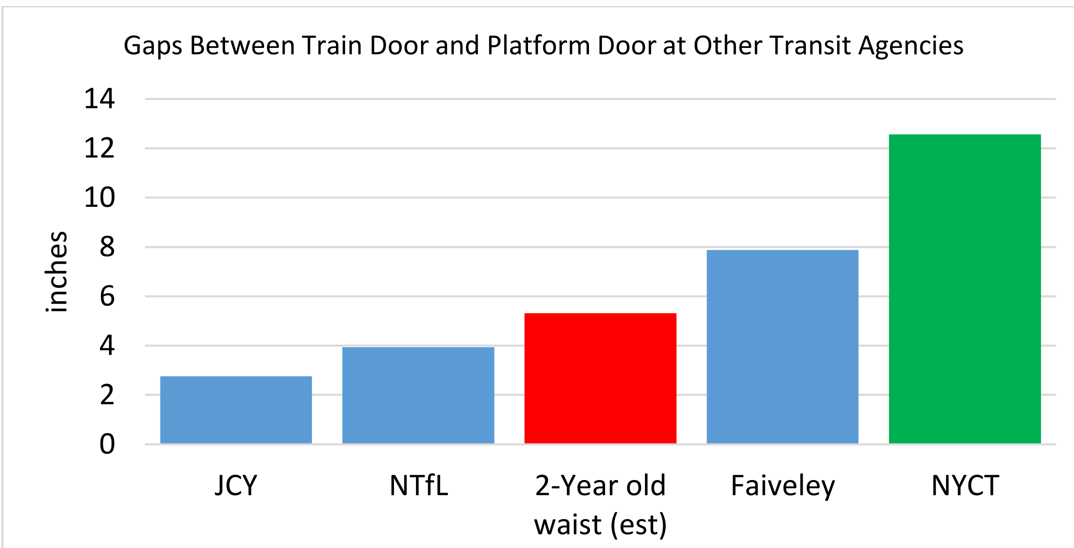


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

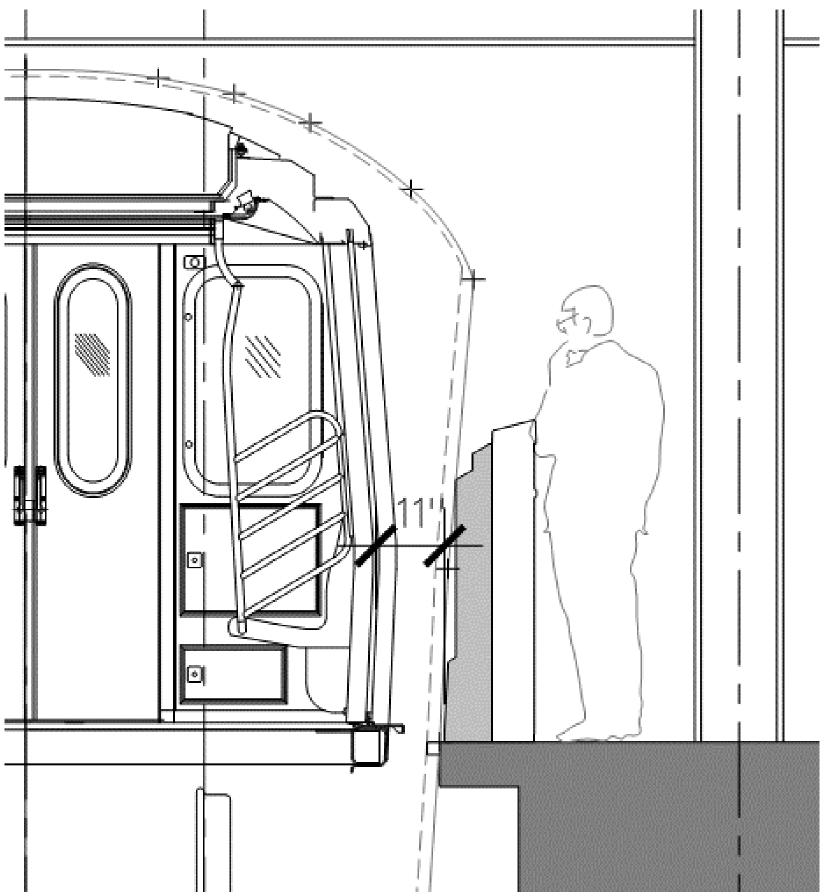


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber "bumpers" on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6" into the line equipment envelope. This would leave a 5" gap between the platform and car doors allowing approximately 2" of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5" by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor's window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor's window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **<u>bold/underline</u>**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	PSD System 1	PSD System 2	PSD System 3
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are "existing" as defined by code. All the rolling stock is also to be considered "existing" under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60" radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36" of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

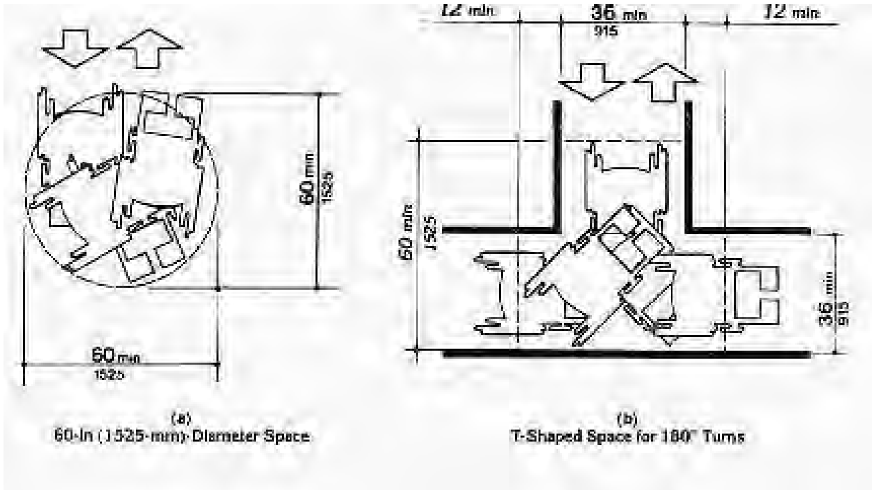
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

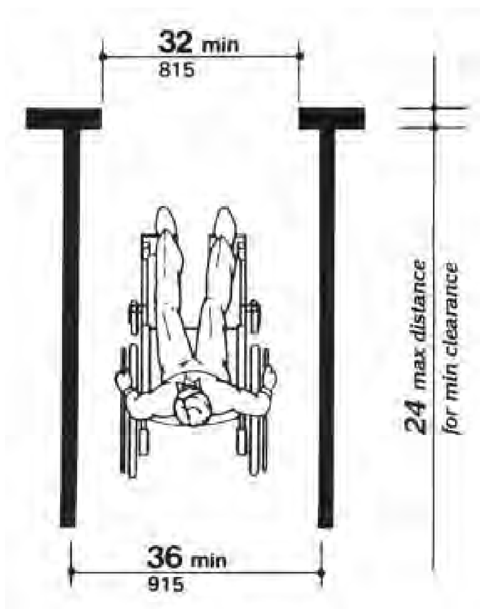


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as “existing”; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60” turning radius in which to make this turn. (the “T” shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an “alteration to the path of travel”, requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32” point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

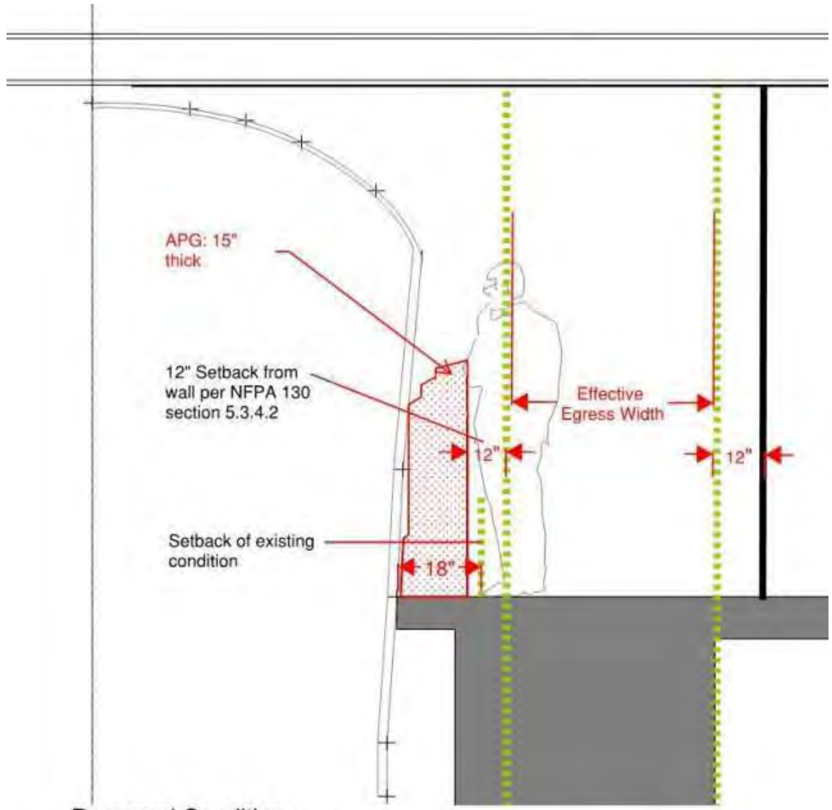
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15” of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

Table of Contents

Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

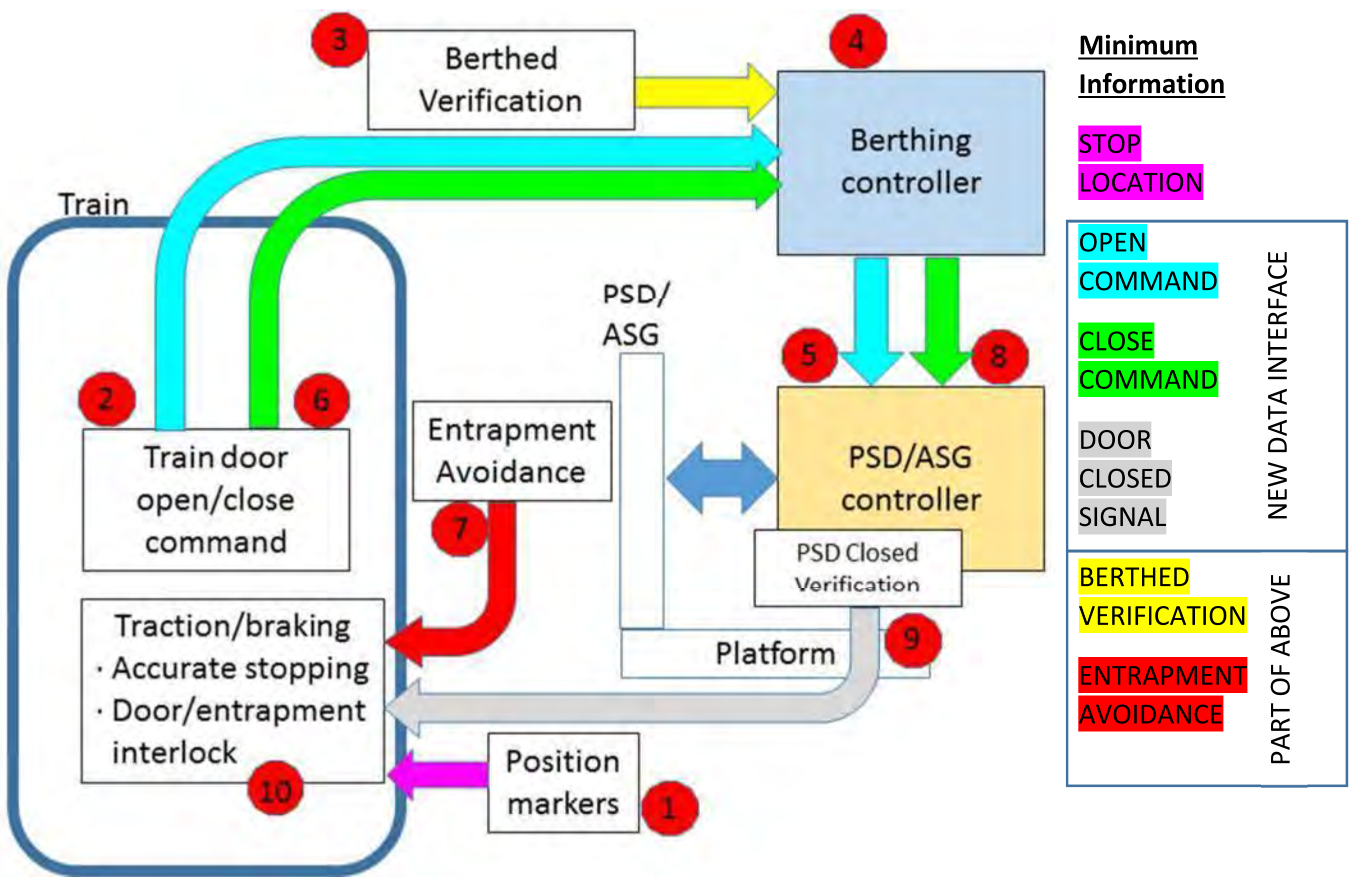
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

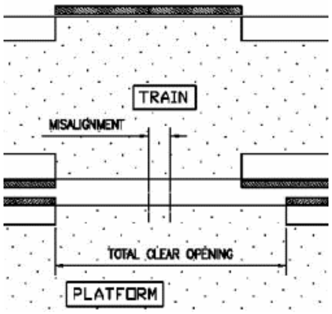
C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5" clear opening, a design for NY should meet the ADA Accessibility Guideline of 36".

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a 'distance totem' which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy's COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically

If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.

For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4'-0"). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

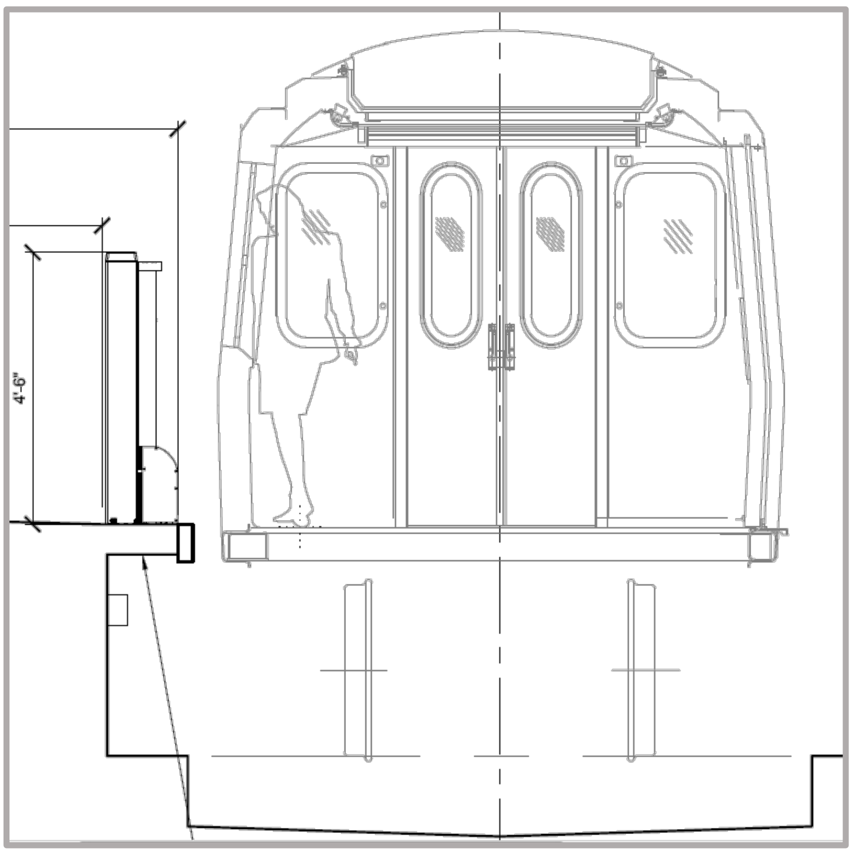


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

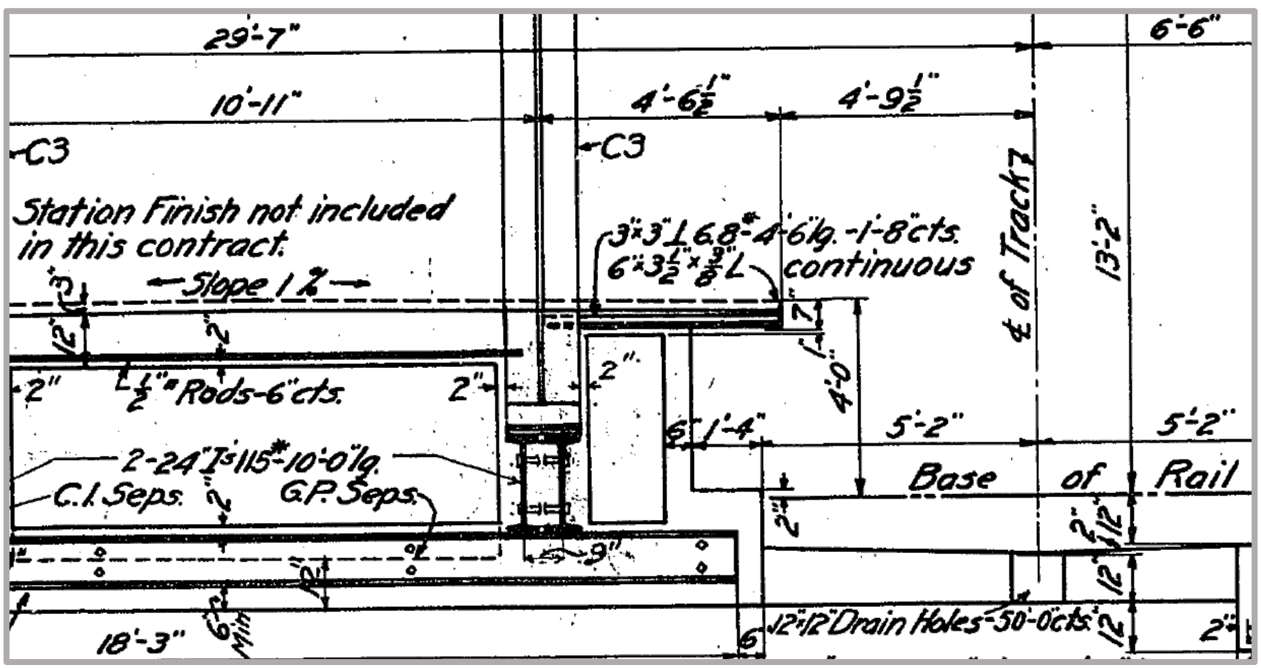


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

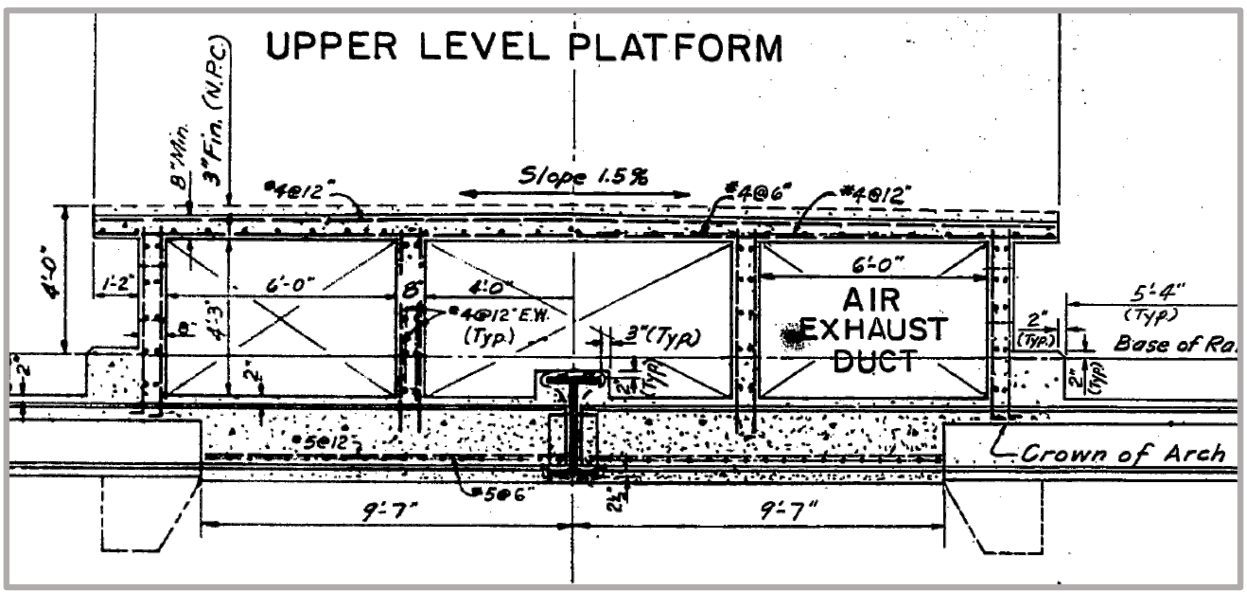


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

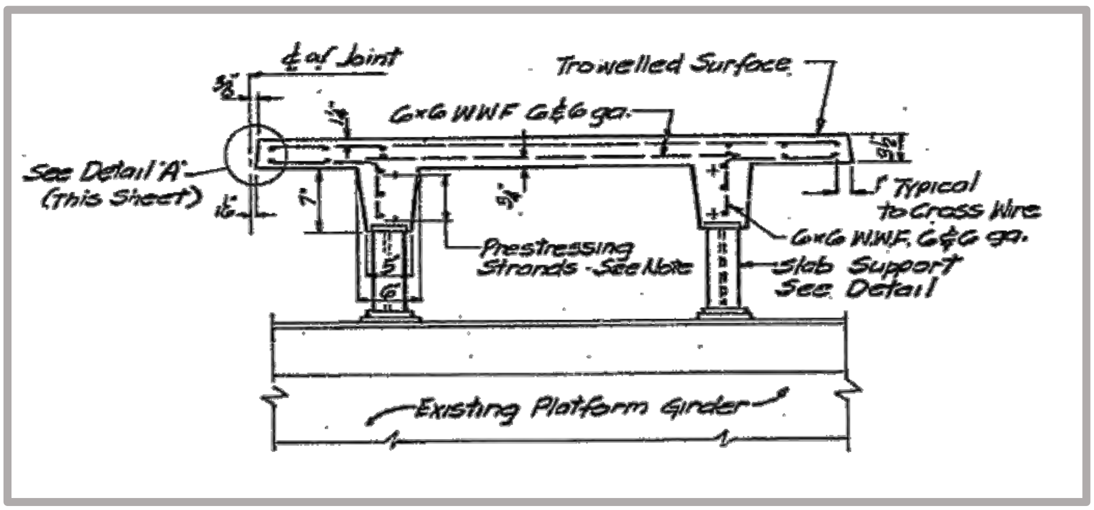


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

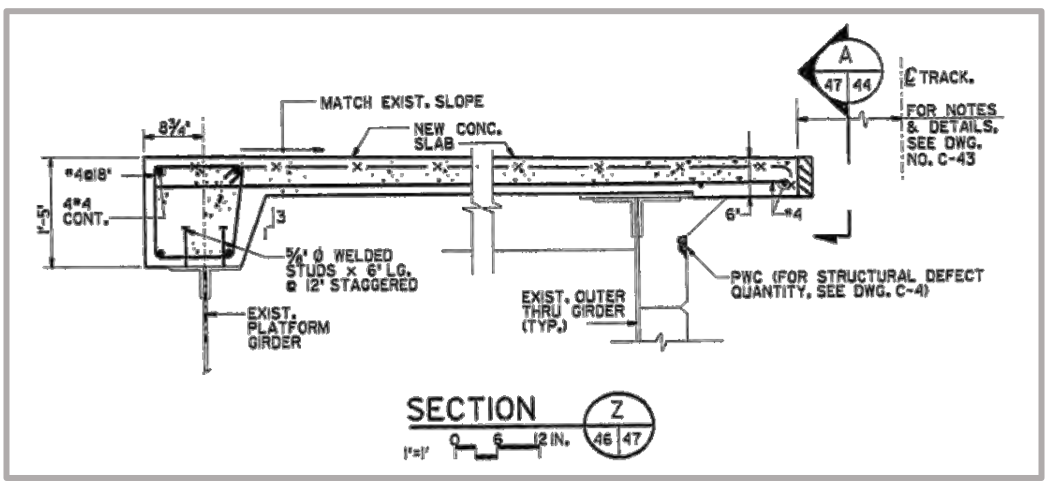


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2'-9"), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

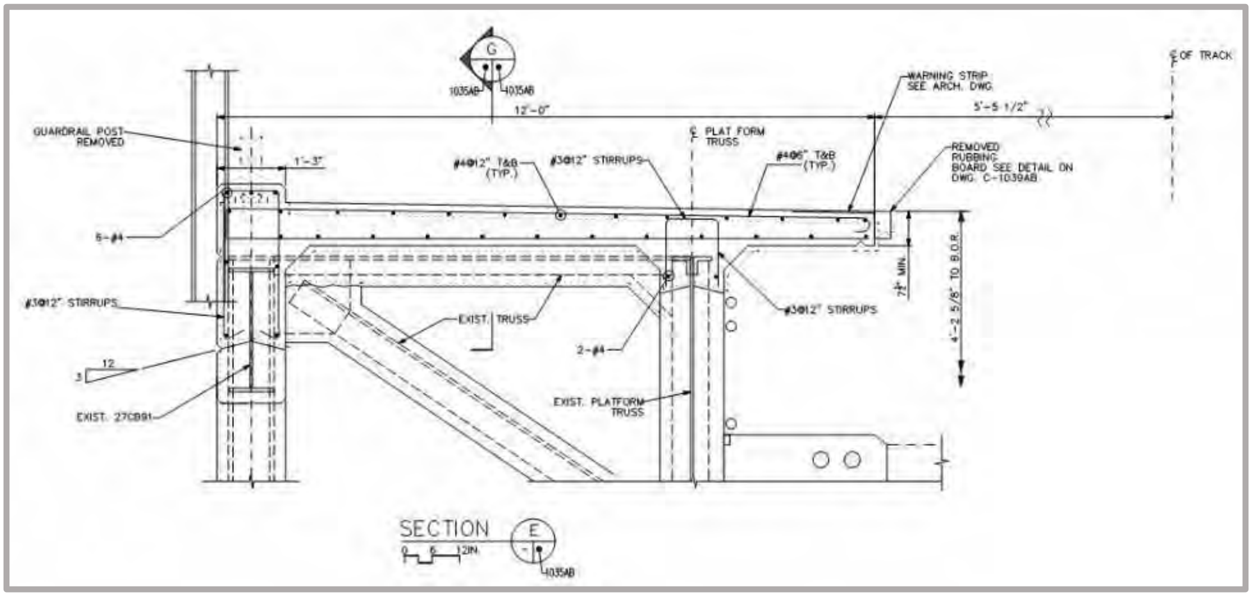


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3" thick structural slab with an approximately 3" thick topping slab. If the topping slab is fully removed, a 6" thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6" thick slab will be sufficient for a cantilever length of up to approximately 3'-0", greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6" structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6" minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

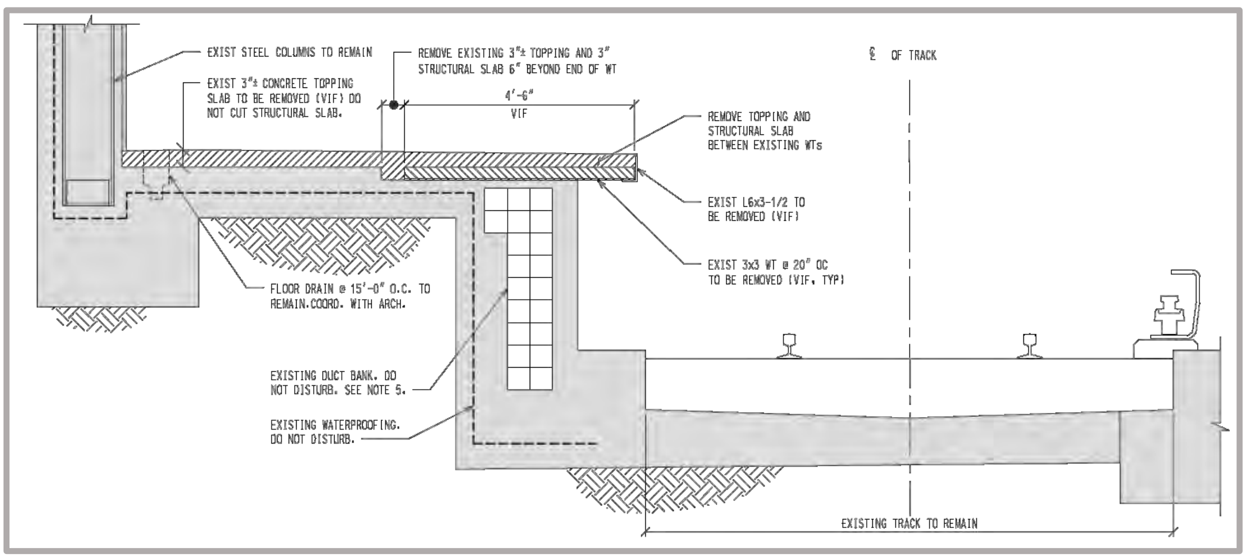


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

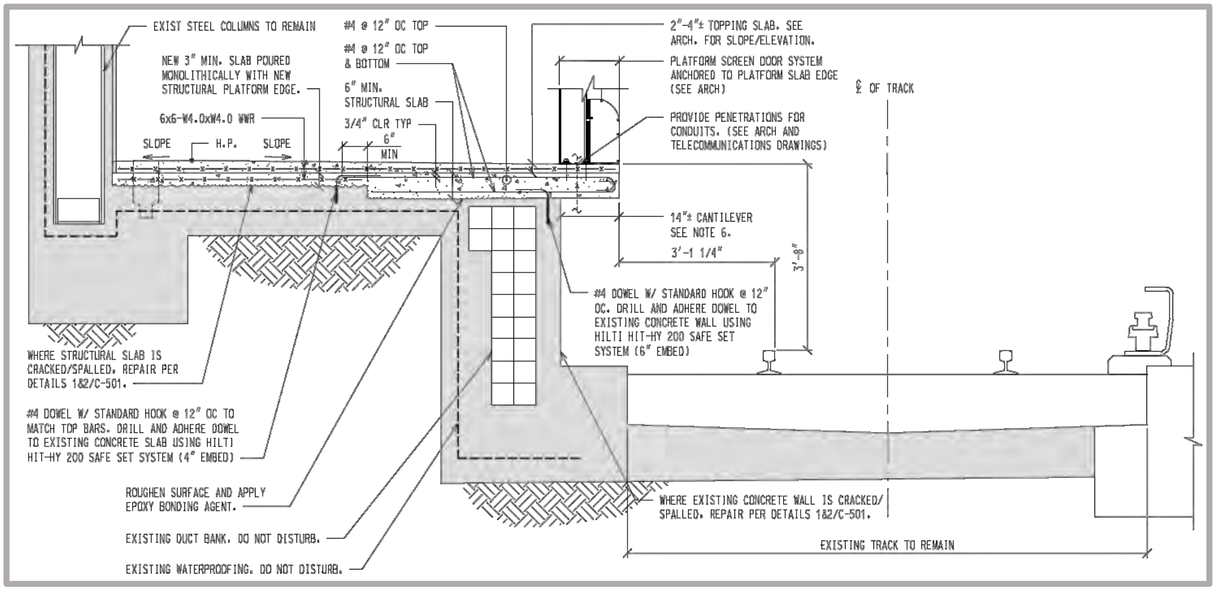


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

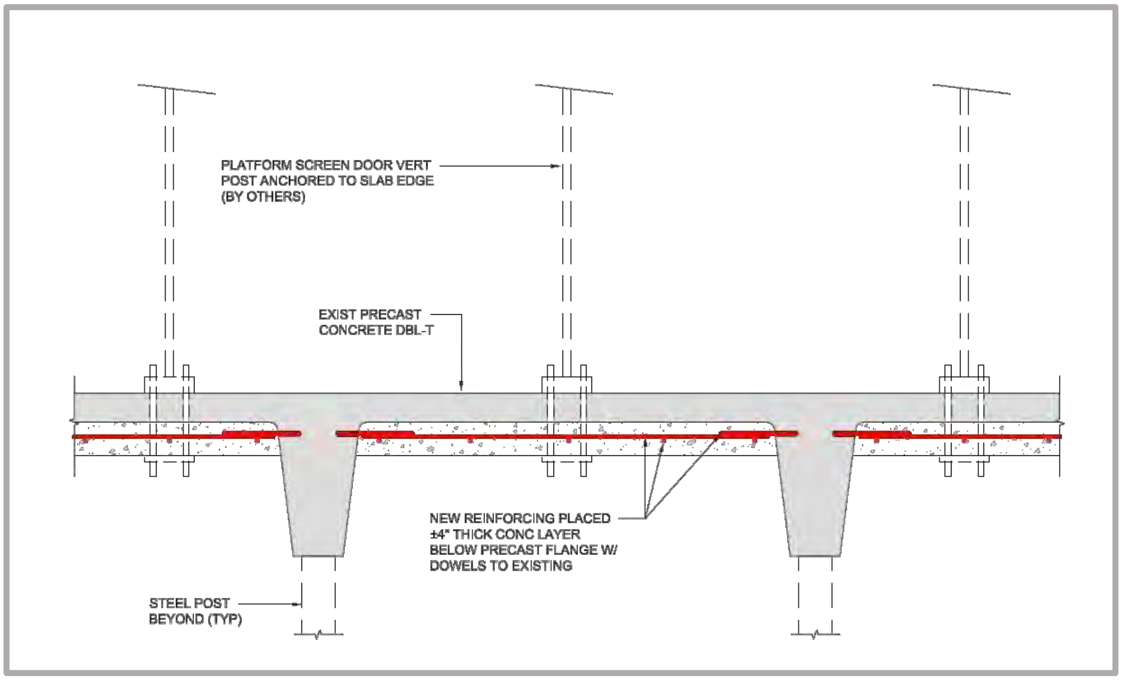


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

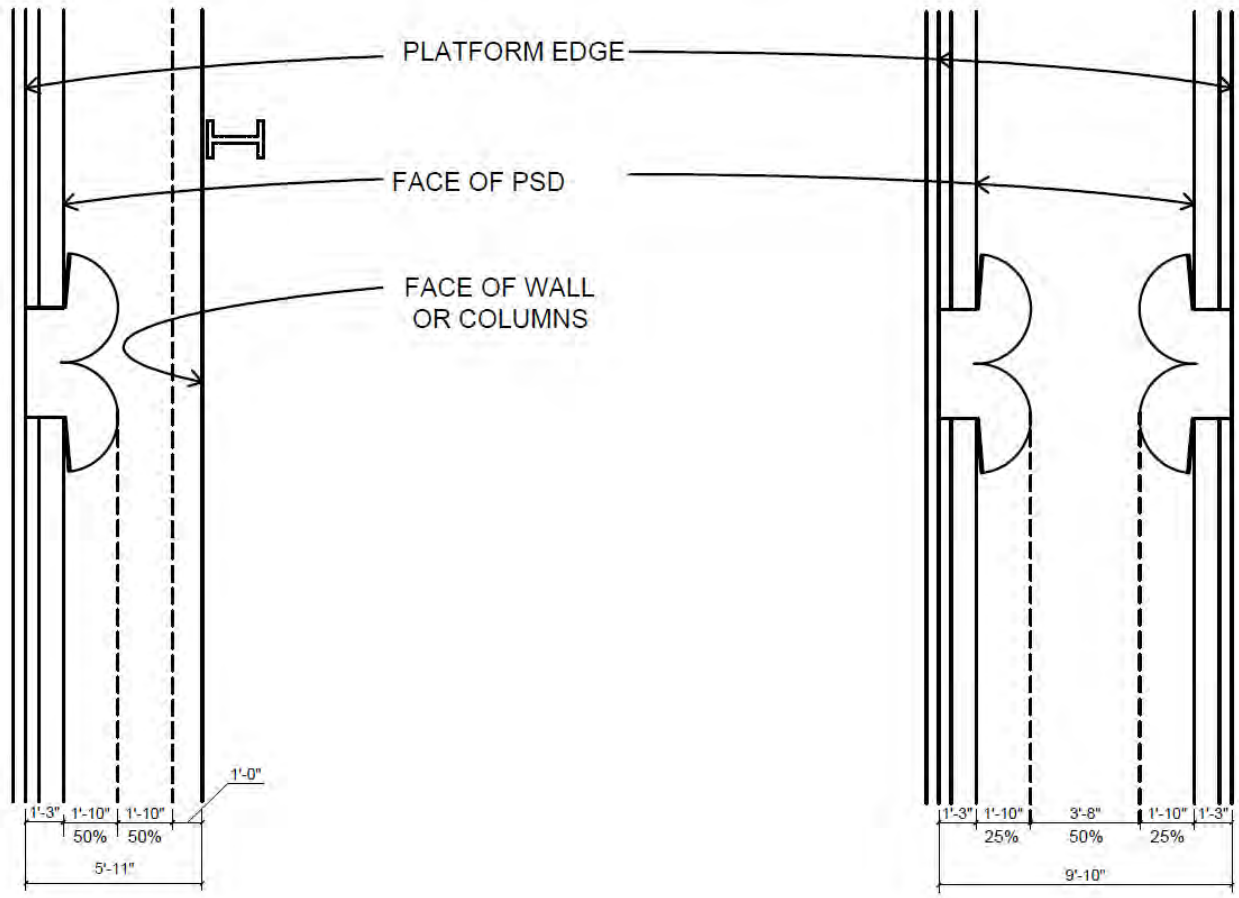
The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5’ – 11” of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis



<u>**FIGURE 1: SIDE PLATFORM**</u>

<u>**FIGURE 2: CENTER PLATFORM**</u>

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	9	$ 63,500 per month [Year 01]	$ 571,500		
		12	$ 83,590 per month [Year 02]	$ 1,003,080		
		12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment.	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
		12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663		

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT
7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *	
		Year 3	$ 257 per hour *	
	Optional :	Year 4	$ 268 per hour *	
	Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

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ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations
ESTIMATE DATE:	January 23, 2019

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VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
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100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

MTA/NYCT

January 23, 2019

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.2 *APGs / PSDs will provide 29 emergency egress doors with push bars per platform*
1.3 *Each platform edge will have 40 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 It is assumed that each train has 10 cars on this line
2.2 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.3 In respect of the PSD option, only platforms that have not been upgraded in the recent past will require platform edge replacement.
2.4 There are no special security requirements made necessary by installation of the APG system
2.5 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.6 This estimate does not provide for the replacement of Platform Edge Lighting
2.7 Premium cost for night time work is considered 50% of total labor cost

3.0 ***Exclusions - Costs not included in the estimate:***

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VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

MTA/NYCT

January 23, 2019

BASIS OF ESTIMATE

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems
3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length
3.4 Costs associated with NYCT State Of Good Repair improvements to the station
3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.
3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs
3.7 Escalation Cost is not included; Anticipate at 5% per annum.
3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.
3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium
3.10 NYCT project cost is not included
3.11 GO and flagging cost is not included
3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or "soft" costs:***

4.1 Design and Construction Contingency
4.2 Contractor O & P
4.3 Insurance
4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 Given the limited time available, no drawings were developed to support this estimate.

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

January 23, 2019

ORDER OF MAGNITUDE COSTS			MRN 299	MRN 300	MRN 324	MRN 325	MRN 326	MRN 328
DESCRIPTION			DYCKMAN STREET	191TH STREET	HOUSTON STREET	CANAL STREET	FRANKLIN STREET	CORTLANDT STREET
1	AUTOMATIC PLATFORM GATES (APG'S)		$14,523,653	$14,348,201	$14,432,734	$14,654,238	$14,378,070	$14,609,175
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$14,523,653	$14,348,201	$14,432,734	$14,654,238	$14,378,070	$14,609,175
4	GENERAL REQUIREMENTS	15.00%	$2,178,548	$2,152,230	$2,164,910	$2,198,136	$2,156,710	$2,191,376
	SUB-TOTAL:		$16,702,201	$16,500,431	$16,597,644	$16,852,373	$16,534,780	$16,800,552
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,175,550	$4,125,108	$4,149,411	$4,213,093	$4,133,695	$4,200,138
	SUB-TOTAL:		$20,877,751	$20,625,539	$20,747,054	$21,065,466	$20,668,475	$21,000,690
6	OVERHEAD & PROFIT	15.00%	$3,131,663	$3,093,831	$3,112,058	$3,159,820	$3,100,271	$3,150,103
	SUB-TOTAL:		$24,009,414	$23,719,370	$23,859,113	$24,225,286	$23,768,747	$24,150,793
7	BONDS & INSURANCE	3.75%	$900,353	$889,476	$894,717	$908,448	$891,328	$905,655
	SUB-TOTAL:		$24,909,767	$24,608,846	$24,753,829	$25,133,735	$24,660,075	$25,056,448
	SUBTOTAL CONSTRUCTION COST W/O ACM		$24,909,767	$24,608,846	$24,753,829	$25,133,735	$24,660,075	$25,056,448
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		$24,909,767	$24,608,846	$24,753,829	$25,133,735	$24,660,075	$25,056,448
10	DESIGN CONSULTANT FEES	10.00%	$2,490,977	$2,460,885	$2,475,383	$2,513,373	$2,466,007	$2,505,645
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		$27,400,743	$27,069,731	$27,229,212	$27,647,108	$27,126,082	$27,562,093
	ADD ALTERNATIVES							
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		$3,543,402	$3,444,995	$3,692,464	$4,075,068	3,472,144	3,835,262
	Add for Markups (as above)	88.66%	3,141,683	3,054,432	3,273,846	3,613,073	3,078,503	3,400,454
	SUB-TOTAL PSD ALTERNATIVE		$6,685,085	$6,499,426	$6,966,310	$7,688,141	$6,550,647	$7,235,715
	TOTAL PROJECT COST (PSD OPTION)		$34,085,828	$33,569,157	$34,195,522	$35,335,249	$33,676,730	$34,797,808

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : DYCKMAN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	550	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	522	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,072**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,072	LF	7	7,504
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,360	SF	12	64,320
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	108	CY	2,500	270,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,074	EA	25	26,850
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,074	EA	25	26,850
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,072	LF	95	101,840
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,072	LF	15	16,080
26	Remove existing platform tiles	1,072	LF	12	12,864
27	Sawcut existing topping concrete at perimeter of removal area	1,072	LF	5	5,360
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,432	SF	8	51,456
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	656	SF	8	5,248
30	New Work				
31	New concrete topping to match existing	1,072	SF	15	16,080

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : DYCKMAN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	656	SF	15	9,840
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,349	SF	750	1,761,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	201,765	201,765
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : DYCKMAN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,072	LF	60	64,320
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	250	LF	60	15,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	300	LF	60	18,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

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STATION : DYCKMAN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,351,612	3,351,612
112					
113	TOTAL PSD WORK:				$ 14,523,653
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,910	SF	750	3,682,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	371,057	371,057
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	71,336
129	L6x6x1/2 continuous angle	8	TONS	17,500	138,074
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : DYCKMAN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,349)	SF	750	(1,761,750)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	201,765	(201,765)
152	Platform Edge Reconstruction work	(1)	LS	503,220	(503,220)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,072)	LF	30	(32,160)
155					
156	Allow loss of production to work at night say 50%	1	LS	817,708	817,708
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 3,543,402

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : 191TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	521	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	521	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,042**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,042	LF	7	7,294
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,210	SF	12	62,520
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	105	CY	2,500	262,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,044	EA	25	26,100
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,044	EA	25	26,100
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,042	LF	95	98,990
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,042	LF	15	15,630
26	Remove existing platform tiles	1,042	LF	12	12,504
27	Sawcut existing topping concrete at perimeter of removal area	1,042	LF	5	5,210
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,252	SF	8	50,016
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10' wide strip	520	SF	8	4,160
30	New Work				
31	New concrete topping to match existing	1,042	SF	15	15,630

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : 191TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	520	SF	15	7,800
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,214	SF	750	1,660,500
61	Spare Parts - Approx. 10% of Material Cost	1	LS	195,690	195,690
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : 191TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,042	LF	60	62,520
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	200	LF	60	12,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	250	LF	60	15,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : 191TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,311,123	3,311,123
112					
113	TOTAL PSD WORK:				$ 14,348,201
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,670	SF	750	3,502,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	360,257	360,257
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	69,376
129	L6x6x1/2 continuous angle	8	TONS	17,500	134,210
130	Drilling and bolting - 4 bolts at each connection	417	EA	216	90,029
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : 191TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,214)	SF	750	(1,660,500)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	195,690	(195,690)
152	Platform Edge Reconstruction work	(1)	LS	492,420	(492,420)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,042)	LF	30	(31,260)
155					
156	Allow loss of production to work at night say 50%	1	LS	794,999	794,999
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 3,444,995

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : HOUSTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	526	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	526	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,052**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,052	LF	7	7,364
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,260	SF	12	63,120
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	106	CY	2,500	265,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,054	EA	25	26,350
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,054	EA	25	26,350
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,052	LF	95	99,940
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,052	LF	15	15,780
26	Remove existing platform tiles	1,052	LF	12	12,624
27	Sawcut existing topping concrete at perimeter of removal area	1,052	LF	5	5,260
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,312	SF	8	50,496
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10' wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,052	SF	15	15,780

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : HOUSTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,259	SF	750	1,694,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	197,715	197,715
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : HOUSTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,052	LF	60	63,120
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	400	LF	60	24,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	450	LF	60	27,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : HOUSTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,330,631	3,330,631
112					
113	**TOTAL PSD WORK:**				**$ 14,432,734**
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,750	SF	750	3,562,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	363,857	363,857
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	70,029
129	L6x6x1/2 continuous angle	8	TONS	17,500	135,498
130	Drilling and bolting - 4 bolts at each connection	421	EA	216	90,893
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	40	HRS	162	6,480
137	Remove signal cables	300	LF	40	12,000
138	Remove conduit; Assuming 1"	300	LF	55	16,500
139	Install conduit in new position	300	LF	110	33,000
140	Install replacement cable; assumed single cable #12	300	LF	125	37,500
141	Re-commission / testing as required	1	EA	12,500	12,500
142	Engineering / Shop Drawings / Etc.	1	EA	7,500	7,500
143	Premium Time	785	HRS	49	38,151
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : HOUSTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,259)	SF	750	(1,694,250)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	197,715	(197,715)
152	Platform Edge Reconstruction work	(1)	LS	496,020	(496,020)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,052)	LF	30	(31,560)
155					
156	Allow loss of production to work at night say 50%	1	LS	852,107	852,107
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 3,692,464

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : CANAL STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	546	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	555	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,101**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,101	LF	7	7,707
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,505	SF	12	66,060
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	111	CY	2,500	277,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,103	EA	25	27,575
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,103	EA	25	27,575
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,101	LF	95	104,595
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,101	LF	15	16,515
26	Remove existing platform tiles	1,101	LF	12	13,212
27	Sawcut existing topping concrete at perimeter of removal area	1,101	LF	5	5,505
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,606	SF	8	52,848
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10' wide strip	506	SF	8	4,051
30	New Work				
31	New concrete topping to match existing	1,101	SF	15	16,515

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : CANAL STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	506	SF	15	7,596
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,480	SF	750	1,859,625
61	Spare Parts - Approx. 10% of Material Cost	1	LS	207,638	207,638
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : CANAL STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,101	LF	60	66,060
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

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STATION : CANAL STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,381,747	3,381,747
112					
113	TOTAL PSD WORK:				$ 14,654,238
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,142	SF	750	3,856,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	381,497	381,497
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	73,230
129	L6x6x1/2 continuous angle	8	TONS	17,500	141,809
130	Drilling and bolting - 4 bolts at each connection	440	EA	216	95,126
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	80	HRS	162	12,960
137	Remove signal cables	600	LF	40	24,000
138	Remove conduit; Assuming 1"	600	LF	55	33,000
139	Install conduit in new position	600	LF	110	66,000
140	Install replacement cable; assumed single cable #12	600	LF	125	75,000
141	Re-commission / testing as required	2	EA	12,500	25,000
142	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
143	Premium Time	1,569	HRS	49	76,253
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : CANAL STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,480)	SF	750	(1,859,625)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	207,638	(207,638)
152	Platform Edge Reconstruction work	(1)	LS	513,910	(513,910)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,101)	LF	30	(33,030)
155					
156	Allow loss of production to work at night say 50%	1	LS	940,400	940,400
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,075,068

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : FRANKLIN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	525	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	525	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,050**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,050	LF	7	7,350
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,250	SF	12	63,000
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	106	CY	2,500	265,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,052	EA	25	26,300
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,052	EA	25	26,300
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,050	LF	95	99,750
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,050	LF	15	15,750
26	Remove existing platform tiles	1,050	LF	12	12,600
27	Sawcut existing topping concrete at perimeter of removal area	1,050	LF	5	5,250
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,300	SF	8	50,400
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-0" wide strip	560	SF	8	4,480
30	New Work				
31	New concrete topping to match existing	1,050	SF	15	15,750

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : FRANKLIN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	560	SF	15	8,400
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
61	Spare Parts - Approx. 10% of Material Cost	1	LS	197,310	197,310
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : FRANKLIN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,050	LF	60	63,000
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : FRANKLIN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,318,016	3,318,016
112					
113	TOTAL PSD WORK:				$ 14,378,070
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,734	SF	750	3,550,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	363,137	363,137
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	69,899
129	L6x6x1/2 continuous angle	8	TONS	17,500	135,240
130	Drilling and bolting - 4 bolts at each connection	420	EA	216	90,720
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : FRANKLIN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,250)	SF	750	(1,687,500)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	197,310	(197,310)
152	Platform Edge Reconstruction work	(1)	LS	495,800	(495,800)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,050)	LF	30	(31,500)
155					
156	Allow loss of production to work at night say 50%	1	LS	801,264	801,264
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				**$ 3,472,144**

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : CORTLANDT STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	540	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	553	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,093**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,093	LF	7	7,651
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,465	SF	12	65,580
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	110	CY	2,500	275,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,095	EA	25	27,375
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,095	EA	25	27,375
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,093	LF	95	103,835
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,093	LF	15	16,395
26	Remove existing platform tiles	1,093	LF	12	13,116
27	Sawcut existing topping concrete at perimeter of removal area	1,093	LF	5	5,465
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,558	SF	8	52,464
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-0" wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,093	SF	15	16,395

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : CORTLANDT STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,444	SF	750	1,832,625
61	Spare Parts - Approx. 10% of Material Cost	1	LS	206,018	206,018
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : CORTLANDT STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,093	LF	60	65,580
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : CORTLANDT STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,371,348	3,371,348
112					
113	TOTAL PSD WORK:				$ 14,609,175
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,078	SF	750	3,808,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	378,617	378,617
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	72,708
129	L6x6x1/2 continuous angle	8	TONS	17,500	140,778
130	Drilling and bolting - 4 bolts at each connection	437	EA	216	94,435
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	40	HRS	162	6,480
137	Remove signal cables	300	LF	40	12,000
138	Remove conduit; Assuming 1"	300	LF	55	16,500
139	Install conduit in new position	300	LF	110	33,000
140	Install replacement cable; assumed single cable #12	300	LF	125	37,500
141	Re-commission / testing as required	1	EA	12,500	12,500
142	Engineering / Shop Drawings / Etc.	1	EA	7,500	7,500
143	Premium Time	785	HRS	49	38,151
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-1 Line Stations

23-Jan-19

STATION : CORTLANDT STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,444)	SF	750	(1,832,625)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	206,018	(206,018)
152	Platform Edge Reconstruction work	(1)	LS	510,530	(510,530)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,093)	LF	30	(32,790)
155					
156	Allow loss of production to work at night say 50%	1	LS	885,060	885,060
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				**$ 3,835,262**

New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR ‘2’ SERVICE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

FINAL SUBMITTAL DATE: March 11, 2019

STV 100 Years

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Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. Our Tier 1 analysis found no instances of door misalignment between car classes for this line. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 61 newly evaluated stations, 56 have been found to be not suitable for the installation of PSDs.

[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to half-height barriers]

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues: the platform edge barriers are 15" wide. Where an existing object (wall, stair, and railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Under the following conditions, PSDs are declared infeasible:
    - Limit the ability of a wheelchair to turn within a 5'-0" circle
    - Limit path of travel to less than a 32" pinch width (defined as an obstruction that measures less than 2'-0" longitudinally, i.e. columns)
    - Limit path of travel to be less than a 36" corridor as defined by the edge of a staircase, railing or room
- Insufficient space for the PSD equipment room: the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow: due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements regarding the placement of these new barriers in an existing station environment.
- Structural considerations: existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.

- Columns at platform edge: at certain stations, the columns are positioned 16" to 24" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space.

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the previously proposed 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the PSD barriers and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is used for refuse removal at most of the 2-line stations. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the (off) loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in damage from these carts along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 8% of the '2' Line stations. Total implementation cost would be \$135.6M for APGs and \$169.9M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; that estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of \$931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 5 feasible stations, the aggregate annual maintenance cost would be \$4.6M.

Summary Table

(8% Feasible 5/ 61)

No.	Station Names	Station Type	Platform Type	Feasibility	Issues/Reason for Failure	Cost APGs	Cost PSDs
310	96th Street West End Ave	SUB	Island	No	ADA Clearance	-	-
311	86th St.	SUB	Side	No	Columns too close to edge	-	-
312	79th Street	SUB	Side	No	Columns too close to edge	-	-
313	72nd Street	SUB	Island	No	ADA Clearance	-	-
314	66th Street Lincoln Center	SUB	Side	No	Columns too close to edge	-	-
315	59th Street Columbus	SUB	Side	No	Columns too close to edge	-	-
316	50th Street	SUB	Side	No	Columns too close to edge	-	-
317	42nd St. Times Square	SUB	Island	No	ADA Clearance	-	-
318	34th Street Penn Station	SUB	Island	No	ADA Clearance	-	-
319	28th Street	SUB	Side	No	ADA Clearance	-	-
320	23rd Street	SUB	Side	No	Non-Compliant Egress Path	-	-
321	18th Street	SUB	Side	No	Non-Compliant Egress Path	-	-
322	14th Street	SUB	Island	No	Non-Compliant Egress Path	-	-
323	Christopher Street	SUB	Side	No	No PSD Room Location	-	-
324	Houston Street Varick St.	SUB	Side	Yes	-	27.2M	34.2M
325	Canal Street	SUB	Side	Yes	-	27.6M	35.3M
326	Franklin Street	SUB	Side	Yes	-	27.1M	33.7M
327	Chambers St. West Bway	SUB	Island	No	ADA Clearance	-	-
331	Park Place	SUB	Island	No	ADA Clearance	-	-
332	Fulton St. William St.	SUB	Island	No	ADA Clearance	-	-
333	Wall Street Fulton St.	SUB	Island	No	ADA Clearance	-	-
334	Clark Street Henry St	SUB	Island	No	ADA Clearance	-	-
335	Borough Hall Court St.	SUB	Side	No	ADA Clearance	-	-
336	Hoyt Street Fulton Mall	SUB	Side	No	ADA Clearance	-	-
337	Nevins Street Flatbush	SUB	Island	No	Columns too close to edge	-	-
338	Atlantic Avenue Barclay	SUB	Side	No	ADA Clearance	-	-
339	Bergen Street	SUB	Side	Yes	-	28.9M	33.3M
340	Grand Army Plaza	SUB	Island	No	ADA Clearance	-	-
341	Eastern Parkway Brooklyn	SUB	Side	No	ADA Clearance	-	-
342	Franklin Avenue Botanic	SUB	Island	No	Columns too close to edge	-	-
353	President Street	SUB	Island	No	ADA Clearance	-	-
354	Sterling Street	SUB	Side	Yes	-	26.7M	33.4M
355	Winthrop Street	SUB	Side	No	ADA Clearance	-	-
356	Church Avenue	SUB	Side	No	No PSD Room Location	-	-
357	Beverly Rd	SUB	Side	No	Non-Compliant Egress Path	-	-
358	Newkirk Avenue	SUB	Side	No	Non-Compliant Egress Path	-	-
359	Flatbush Avenue Brooklyn	SUB	Side	No	ADA Clearance	-	-
416	241st St. Wakefield	ELV	Island	No	Precast Platform	-	-
417	238th Street Nereid Ave.	ELV	Side	No	Precast Platform	-	-
418	233rd St.	ELV	Side	No	Precast Platform	-	-
419	225th Street	ELV	Side	No	Precast Platform	-	-
420	219th Street	ELV	Side	No	Precast Platform	-	-
421	Gun Hill Road	ELV	Island	No	Precast Platform	-	-
422	Burke Avenue	ELV	Side	No	Precast Platform	-	-

423	Allerton Avenue	ELV	Side	No	Precast Platform	-	-
424	Pelham Parkway	ELV	Side	No	Precast Platform	-	-
425	Bronx Park East	ELV	Side	No	Precast Platform	-	-
426	East 180th Street Morris	ELV	Island	No	Precast Platform	-	-
427	West Farm Sq. / E.	ELV	Side	No	Precast Platform	-	-
428	174th Street	ELV	Side	No	Precast Platform	-	-
429	Freeman St.	ELV	Side	No	Precast Platform	-	-
430	Simpson Street	ELV	Side	No	Precast Platform	-	-
431	Intervale Avenue	ELV	Side	No	Precast Platform	-	-
432	Prospect Avenue	ELV	Side	No	Precast Platform	-	-
433	Jackson Avenue	ELV	Side	No	Precast Platform	-	-
434	3rd Avenue 149th Street	SUB	Side	No	Columns too close to edge	-	-
435	149th Street Grand	SUB	Side	No	ADA Clearance	-	-
438	135th Street	SUB	Side	No	Columns too close to edge	-	-
439	125th Street	SUB	Side	No	Columns too close to edge	-	-
440	116th Street	SUB	Side	No	Columns too close to edge	-	-
441	110th Street Central Park	SUB	Side	No	Non-Compliant Egress Path		
					Totals	135.6M	169.9M

1.0 Station Assessments

1.01 – MR 310 | 96th Street Station

Summary: *96th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 31" (see figure 1).*

Description

The 96th Street Station is a below-grade station with two straight center/ island platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 13'-6' to 17'-8". The corridor width at this station's elevators is 46". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 31" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
96th Street Station

1.02 – MR 311 | 86th Street Station

Summary: *86th Street Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

86th Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 16" from the edge*
86th Street Station

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1.03 – MR 312 | 79th Street Station

Summary: *79th Street Station is not feasible for both APGs and PSDs as the columns which are located 15" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

79th Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 15" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

***Figure 1 –** Column 15" from the edge*
79th Street Station

1.04 – MR 313 | 72nd Street Station

Summary: *72nd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at five platform stairs as the remaining width would be 15" (see figure 1).*

Description

The 72nd Street Station is a below-grade station with two straight center/island platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 15'-6". The corridor width at this platform stairs is 30". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 15" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
72nd Street Station

1.05 – MR 314 | 66th Street / Lincoln Center Station

Summary: *66th Street Station is not feasible for both APGs and PSDs as the columns which are located 18" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

66th Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 18" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 18" from the edge*
66th Street Station

1.06 – MR 315 | 59th Street / Columbus Circle Station

Summary: *59th Street Station is not feasible for both APGs and PSDs as the columns which are located 18" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

59th Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 18" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

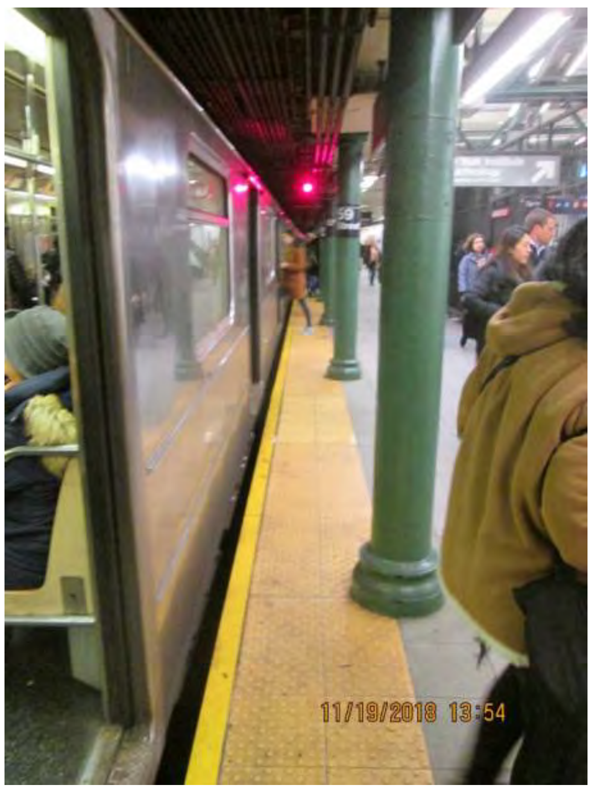

***Figure 1 –** Column 18" from the edge*
59th Street Station

1.07 – MR 316 | 50th Street Station

Summary: *50th Street Station is not feasible for both APGs and PSDs as the columns which are located 18" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

50th Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 18" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 18" from the edge*
50th Street Station

1.08 – MR 317 | 42nd Street / Times Square Station

Summary: *42nd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at the south end of the platform as the remaining width would be 27" (see figure 1).*

Description

The 42nd Street Station is a below-grade station consisting two center / island platforms. The platforms are approximately 21'-2" wide throughout. At the southern end of the northbound platform there are 42" between the column and the platform edge. The implementation of a platform edge barrier would reduce this width to 27" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
42nd Street Station

1.09 – MR 318 | 34th Street Penn Station

Summary: *34th Street Penn Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the southbound platform as the existing width is 5'-0" (see figure 1).*

Description

34th Street Station is a below-grade station consisting of both side and center / island platform. The express 2 and 3 trains utilize the center / island platform. The platform is approximately 24'-8"' wide throughout, narrowing to 5'-0" at the south end of the southbound platform and 5'-3" at the northbound platform. Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress via emergency exit doors with an installed PSD system. See figure 1 for reference.

Figure 1 *– Non-Compliant egress condition*
34th Street Station

1.10 – MR 319 | 28th Street Station

Summary: *28th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at south end of the southbound platform as the remaining width would be 33" (see figure 1).*

Description

The 28th Street Station is a below-grade station with two platforms. The platform structures are cast-in-place concrete. The width of the platforms are approximately 11'-10". The implementation of a platform edge barrier would reduce this width at the south end of the southbound platform below the required minimum of 36". The remaining 33" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

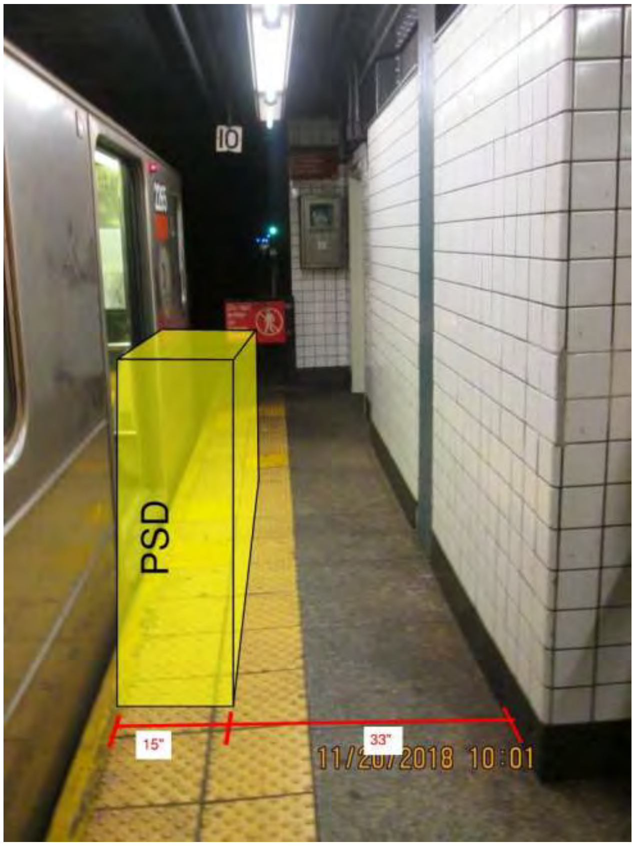

Figure 1 *– Non-Compliant ADA condition*
28th Street Station

1.11 – MR 320 | 23rd Street Station

Summary: *23rd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the northbound platform as the existing width is 5'-10" (see figure 1).*

Description

23rd Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-10' to 11'-10".

Platform width at the ends of the northbound & southbound platform are 5'-10" or 70". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

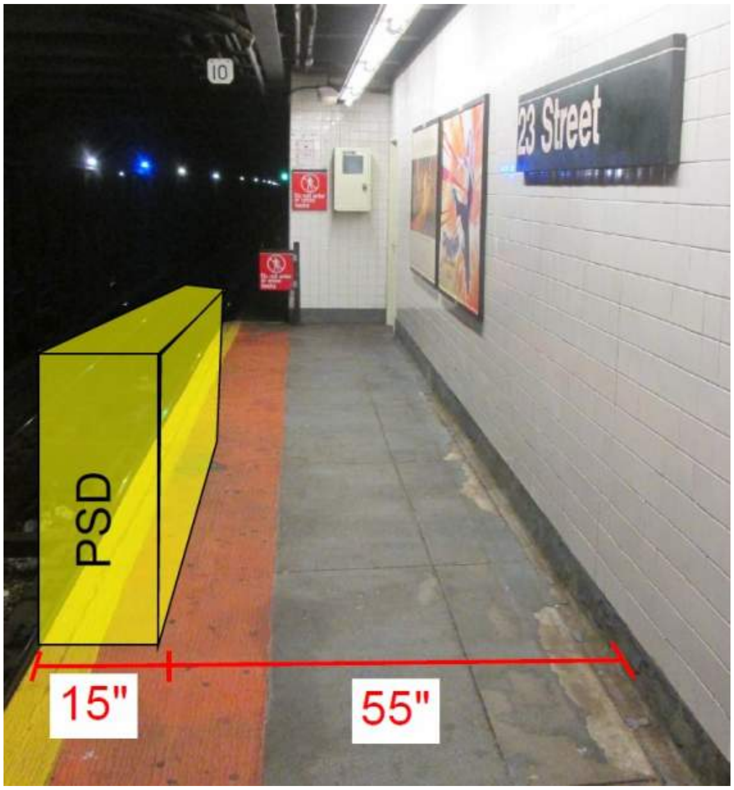

***Figure 1** – Non-Compliant egress condition*
23rd Street Station

1.12 – MR 321 | 18th Street Station

Summary: *18th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the southbound platform as the existing width is 5'-0"" (see figure 1).*

Description

18th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-0' to 11'-6".

Platform width at the southern end of the southbound platform is 5'-0" or 60". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

***Figure 1** – Non-Compliant egress condition*
18th Street Station

1.13 – MR 322 | 14th Street Station

Summary: *14th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the northbound platform as the existing width is 5'-0"" (see figure 1).*

Description

14th Street Station is a below-grade station with two straight center/ island platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-0' to 19'-4".

Platform width at the southern end of both platforms is 5'-0" or 60". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

***Figure 1** – Non-Compliant egress condition*
14th Street Station

1.14 – MR 323 | Christopher Street Station

Summary: *Christopher Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

Christopher Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. Platform widths vary from 10'-4" to 11'-8". There is a single row of columns on each platform.

Due to the limited width of the existing platforms, there is no available space for the equipment room. Figure 2 below shows the minimum width required (12'-11") for construction of a PSD equipment room on a station platform. Figure 1, below, demonstrates the lack of available space within the southbound control area. The northbound control area is similar.

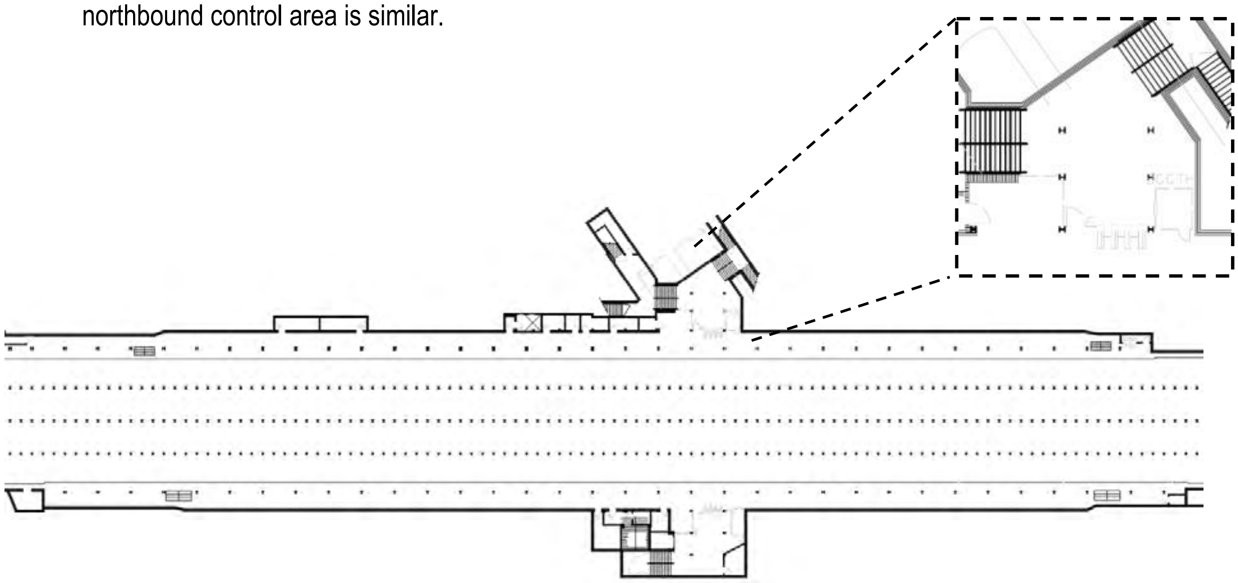

Figure 1 *– Congested/Narrow Station Plan*
Christopher Street Station

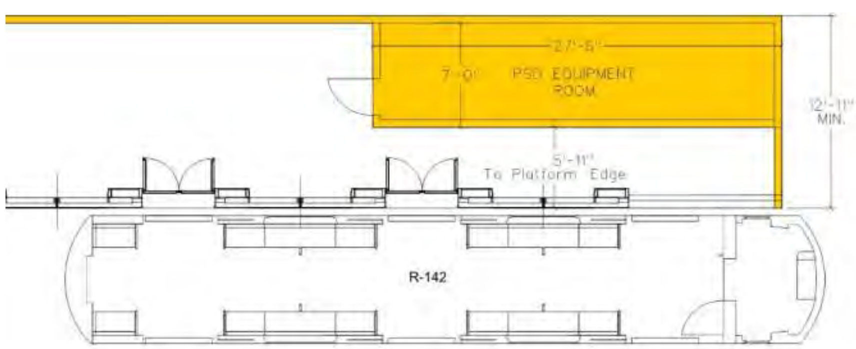

Figure 2 – *Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimension

1.15 – MR 324 | Houston Street Station

Summary: *Houston Street is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Houston Street Station is a below ground station with two side platforms (**see Figure 1**). The platform structures are cast-in-place concrete. Columns are located throughout the length of the platforms along the platform edge. Column faces measure approximately 4'-0" from the platform edge. The platform widths are approximately 12-0" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the southbound control area of the station (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed in the early 1990's. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for '2' Line Stations
(Houston Street Station)

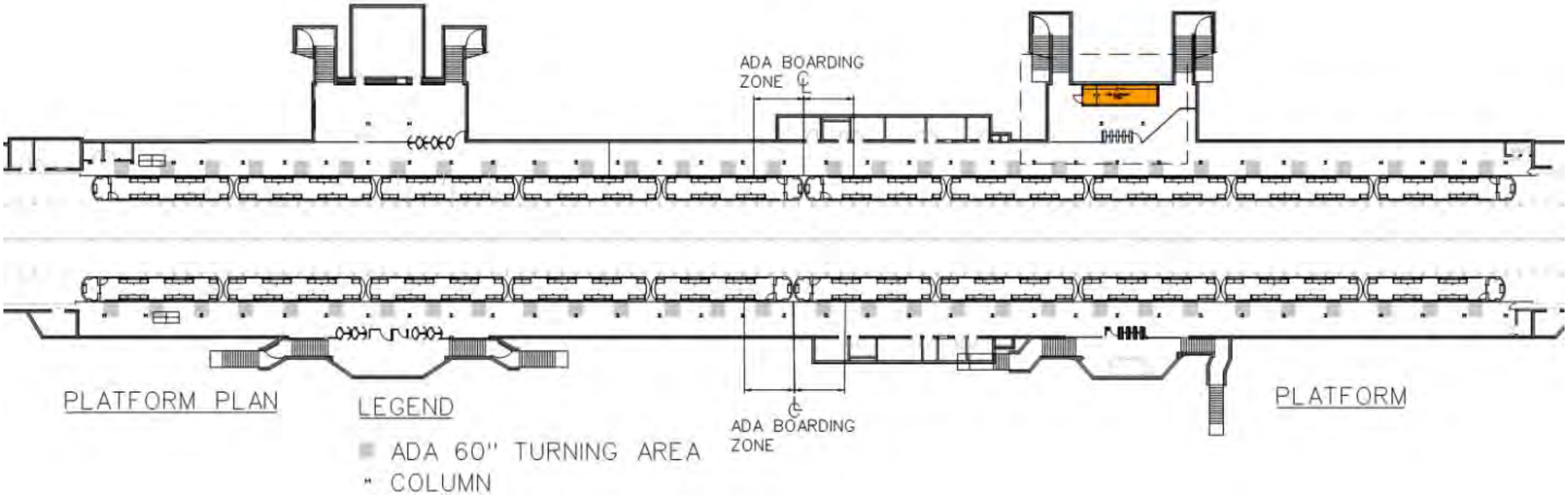

***Figure 1** – Overall Station Plan*
Houston Street Station

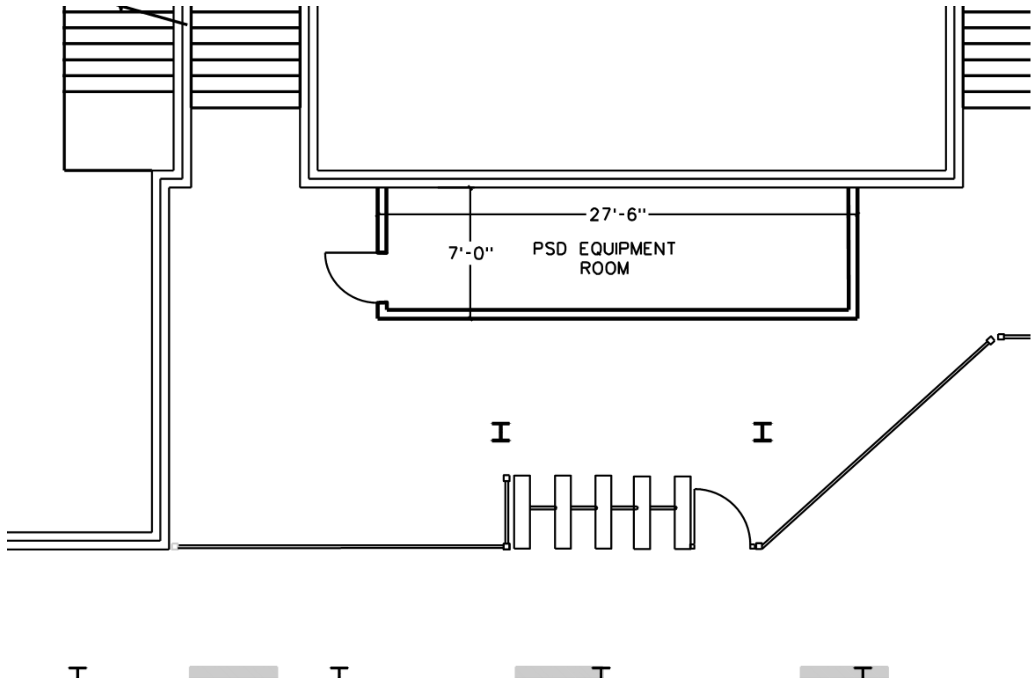

Figure 2 *– PSD Equipment Room 1 Detail*
Houston Street Station

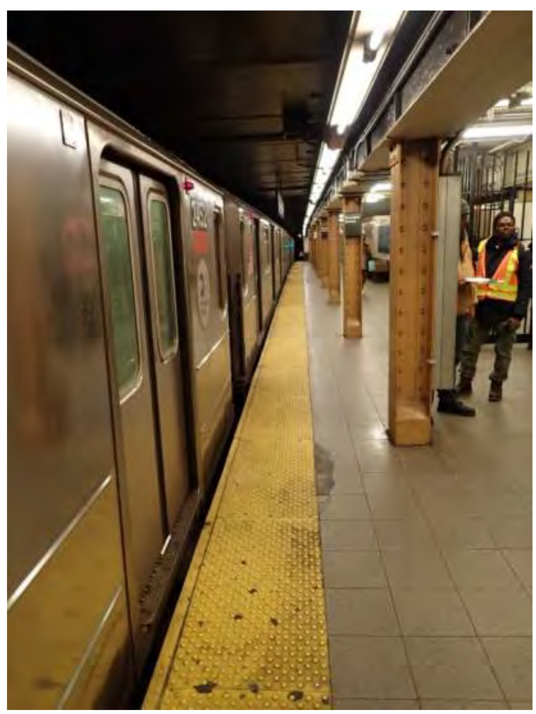

Figure 3 *– Typical platform view*
Houston Street Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 & Table 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (normal service)

Station Name	Houston Street Varick St.
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	40.8
Apparent Power (kVA)	51.0
Station Peak Demand Load, Max Current, (A)	141.7
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	299
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	501
Is Electrical Service Adequate?	**Yes**
Notes	Service capacity data is based on observations of breaker schedule. Only partial one line diagram (for tunnel lighting) is available.

Table 1. Normal Service Power Capacity Analysis

Station
Power Capacity Analysis (reserve service)

Station Name	Houston Street Varick St.
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	10.4
Apparent Power (kVA)	13.0
Station Peak Demand Load, Max Current, (A)	36.0
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	194
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	606
Is Electrical Service Adequate?	**Yes**
Notes	Service capacity data is based on observations of breaker schedule. Only partial one line diagram (for tunnel lighting) is available.

***Table 2**. Reserve Service Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be \$27.2M to install APGs and \$34.2M to install PSDs (See Appendix E)

1.16 – MR 325 | Canal Street Station

Summary: *Canal Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Canal Street Station is a below ground station with two side platforms (**see Figure 1**). The platform structures are cast-in-place concrete. Columns are located throughout the length of the platforms along the platform edge. Column faces measure approximately 4'-0" from the platform edge. The platform widths are approximately 12-0" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the abandoned passageway at the south end of the station (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed in the early 1990's. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would only be required for the installation of an APG system.

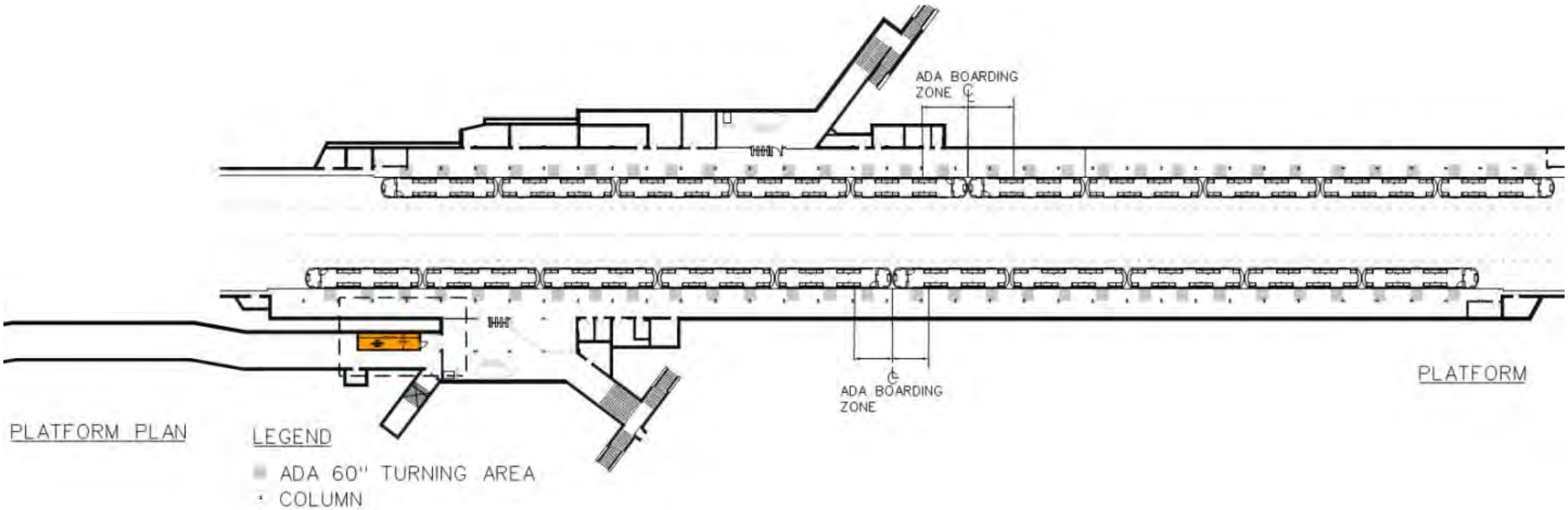

Figure 1 *– Overall Station Plan*
Canal Street Station

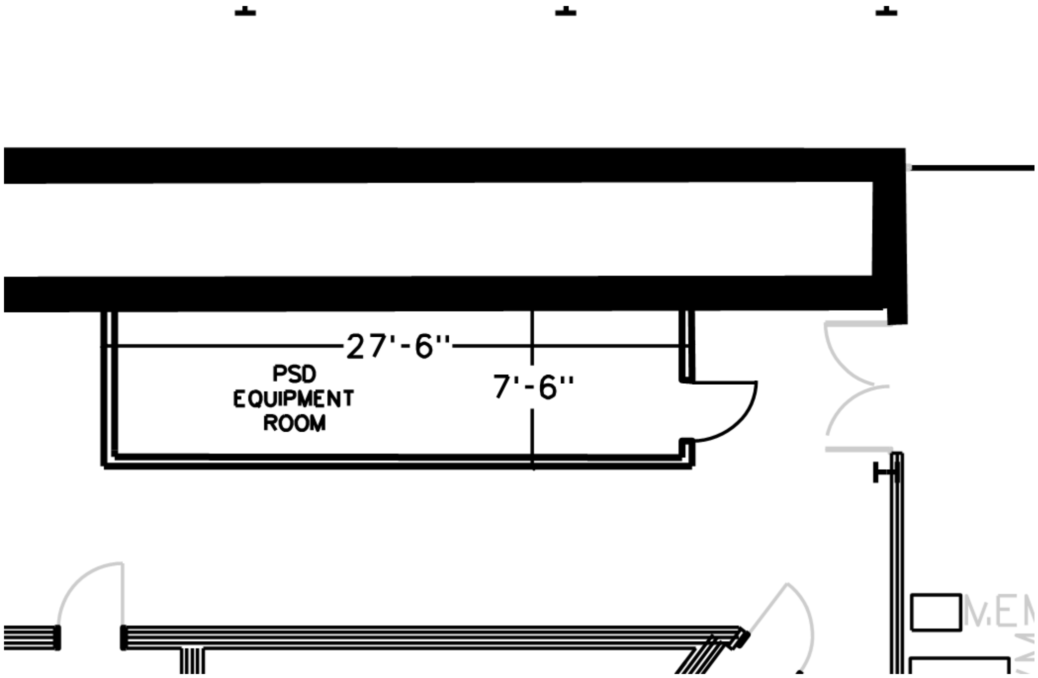

Figure 2 *– PSD Equipment Room 1 Detail*
Canal Street Station

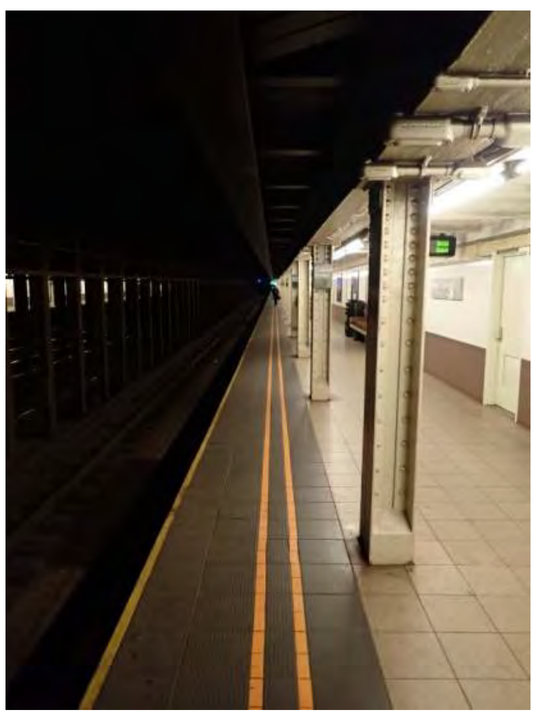

Figure 3 *– Typical platform view*
Canal Street Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge on the inside face of the columns. No lighting re-configuration will be required as a result of a PSD installation.

Power:

The Normal EDR was not accessible at the time of survey. However, the electrical reserve service has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (reserve service)

Station Name	Canal Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	37.2
Apparent Power (kVA)	46.5
Station Peak Demand Load, Max Current, (A)	130.0
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	288
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	312
Is Electrical Service Adequate?	**Yes**
Notes	Service capacity data is based on observations of breaker schedule. Only partial one line diagram (for tunnel lighting) is available. Also the above capacity is based on demand KW for Reserve power.

***Table 1**. Reserve Service Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.6M to install APGs and $35.3M to install PSDs (See Appendix E)

1.17 – MR 326 | Franklin Street Station

Summary: *Franklin Street is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Franklin Street Station is a below ground station with two side platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are located throughout the length of the platforms along the platform edge. Column faces measure approximately 4'-0" from the platform edge. The platform widths are approximately 11-4" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the northbound control area of the station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed in the early 1990's. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would only be required for the installation of an APG system.

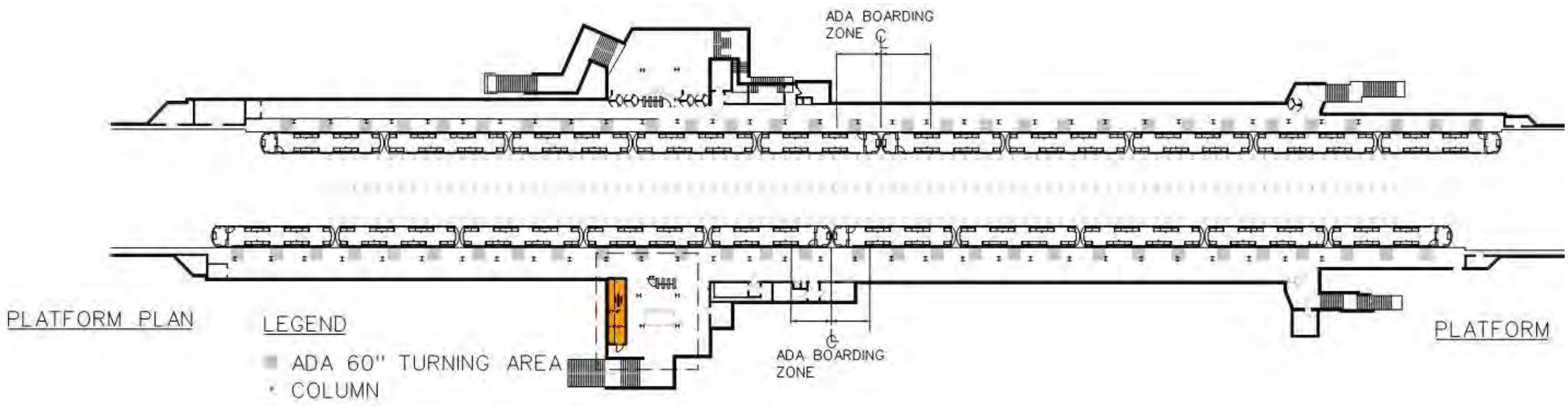

Figure 1 – *Overall Station Plan*
Franklin Street Station

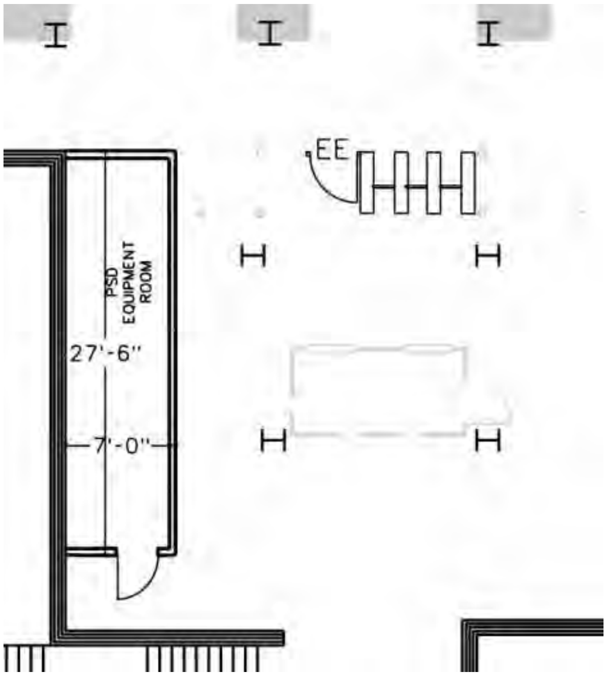

Figure 2 – *PSD Equipment Room 1 Detail*
Franklin Street Station

Figure 3 – *Typical platform view*
Franklin Street Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

The Reserve EDR was not accessible at the time of survey. However, the Normal electrical service has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (normal service)

Station Name	Franklin Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	39.6
Apparent Power (kVA)	49.5
Station Peak Demand Load, Max Current, (A)	137.5
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	296
Station Service Power Capacity, (Main SB or SG Rating), (A)	600
Service Spare Capacity, (A)	304
Is Electrical Service Adequate?	**Yes**
Notes	Service capacity data is based on observations of breaker schedule.

Table 1. *Normal Service Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.1M to install APGs and $33.7M to install PSDs (See Appendix E)

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1.18 – MR 327 | Chambers Street Station

Summary: *Chambers Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 31" (see figure 1).*

Description

The Chambers Street Station is a below-grade station with two straight center / island platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 17'-2". The corridor width at the southern end of the southbound platform is 46". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 31" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
Chambers Street Station

1.19 – MR 331 | Park Place Station

Summary: *Park Place Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at the escalator as the remaining width would be 23" (see figure 1).*

Description

The Park Place Station is a below-grade station with one straight center/island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 17'-10". At the columns on either side of the escalator, there is 38" clearance. The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 23" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
Park Place Station

1.20 – MR 332 | Fulton St. Station

Summary: *Fulton St. Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 31" (see figure 1).*

Description

The Fulton Street Station is a below-grade station with one straight center / island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 13'-6" throughout. At the south end of the southbound platform, the existing clearance is 46". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 31" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-compliant ADA condition*
Fulton Street Station

1.21 – MR 333 | Wall Street Station

Summary: *Wall Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 17" (see figure 1).*

Description

The Wall Street Station is a below-grade station with one center / island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 14'-0", narrowing to 6'-6" at the end. At several of the stairs, the existing clearance is 32". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 17" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

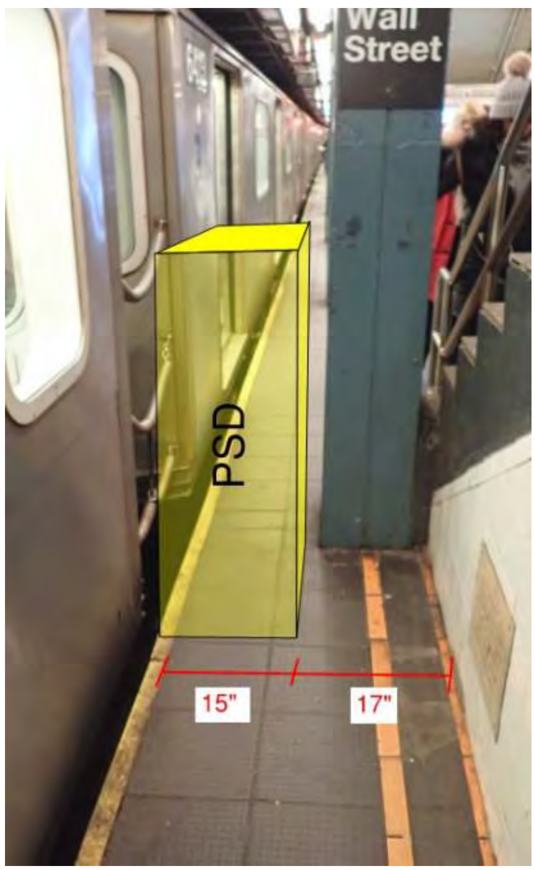

Figure 1 *– Non-compliant ADA condition*
Wall Street Station

1.22 – MR 334 | Clark Street Station

Summary: *Clark Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 9" (see figure 1)..*

Description

Clark Street Station is a below-grade station with one center / Island platform. The platform structure is cast in place concrete. The width of the platform is approximately 15'-6. At the two stairs, columns flanking the stairs leave 24" of clearance. The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 9" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
Clark Street Station

1.23 – MR 335 | Borough Hall Station

Summary: *Borough Hall Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 23" (see figure 1).*

Description

Borough Hall Station is a below-grade station with two straight side platforms. The platform structures are cast in place concrete. The width of the platforms varies from 3'-2" to 11'- 8". At the south end of the southbound platform the corridor width to the platform wall is only 3'-2". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 23" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

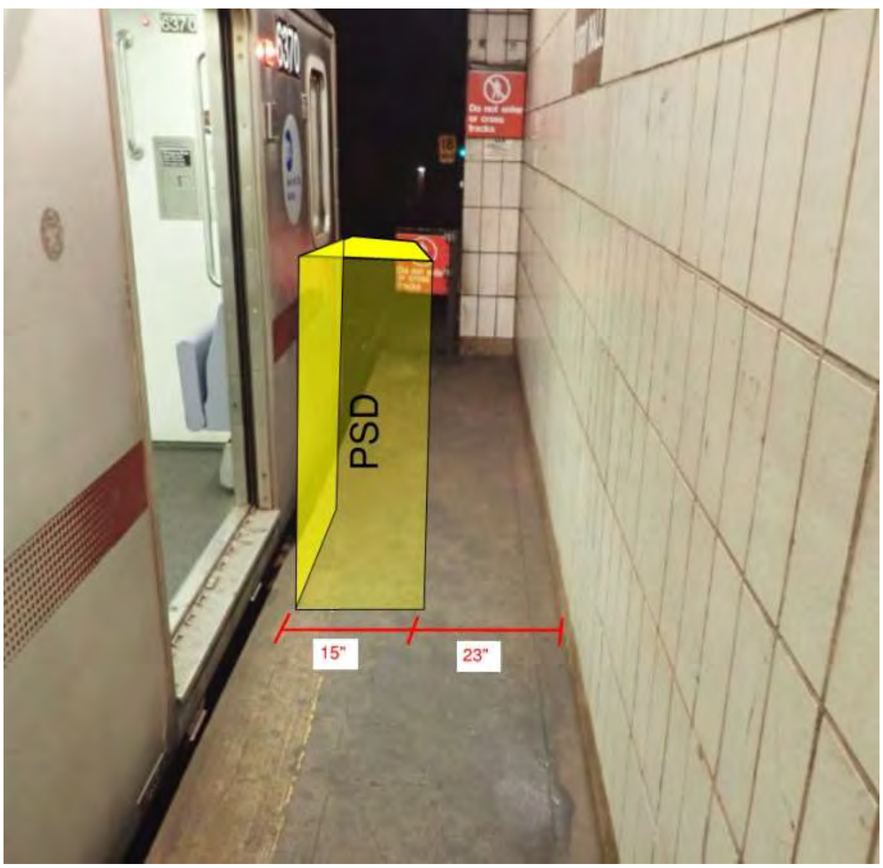

***Figure 1** – Non-compliant ADA condition*
Borough Hall Station

1.24 – MR 336 | Hoyt Street Station

Summary: *Hoyt Street Station is not feasible for both APGs and PSDs. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at the north end of the northbound as the remaining width would be 19" (see figure 1).*

Description

Hoyt Street Station is a below-grade station with two straight side platforms. The platform structures are cast in place concrete. The width of the platforms varies from 11'-0" to 13'- 0, and narrowing at the ends. At the north end of the northbound platform, the existing clearance at the columns is 34". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 19" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

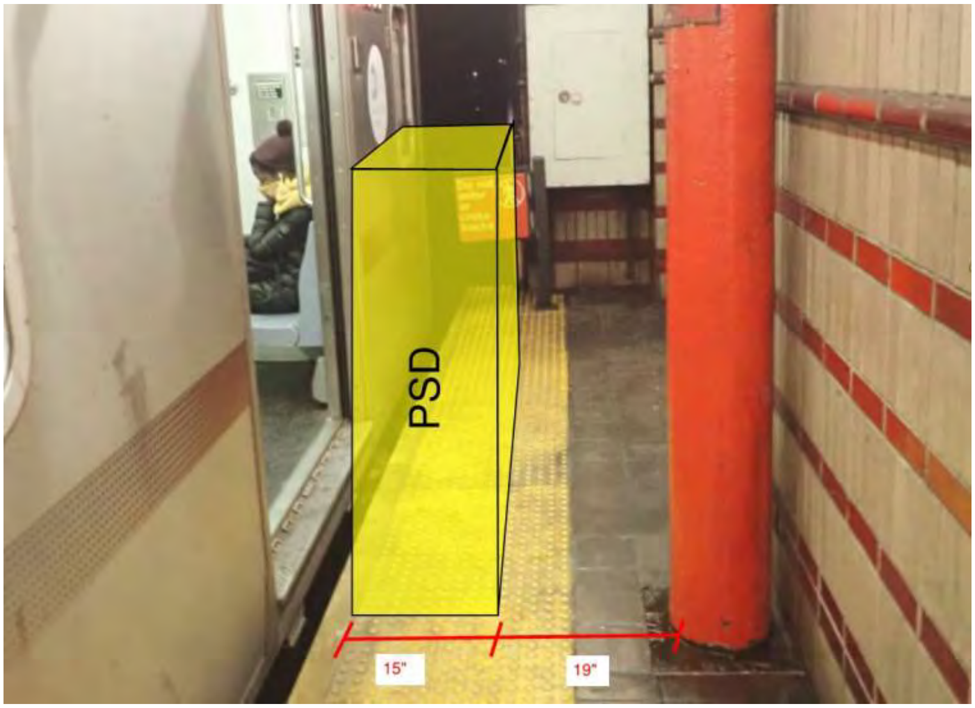

Figure 1 *– Non-compliant ADA condition*
Hoyt Street Station

1.25 – MR 337 | Nevins Street Station

Summary: *Nevins Street Station is not feasible for both APGs and PSDs as the columns which are located 20" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description

Nevins Street Station is a below-grade station with two center / island platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 20" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios

Figure 1 *– Non-compliant ADA condition*
Nevins Street Station

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1.26 – MR 338 | Atlantic Avenue Barclay Ctr Station

Summary: *Atlantic Avenue Barclay Ctr. Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 21" (see figure 1).*

Description

The Atlantic Avenue Barclay Ctr. Station is a below-grade station with two straight side platforms and a center / island platform. The 2 trains stop at the side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 6'-8' to 18'-0". The corridor width at the staircase at the south end of the southbound platform is 36". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 21" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

The non-compliant condition noted above could be remedied by moving the stopping location of the train. The proposal to move the stopping position of trains in specific stations would need to be studied by NYCT Signals Engineering to determine the impact to signals and signals equipment between that station and a series of adjacent stations all the way to the nearest interlocking. In many cases signals equipment at several locations would need to be relocated and rewired. The only way to fully determine this is to make an analysis of the existing signals system in that area.

Since that type of task is outside the scope of the PSD Feasibility Study, it is concluded that the current train stopping position is fixed. Given this condition, the ADA and/or Code analysis is being used for the feasibility analysis.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
Atlantic Ave Station

1.27 – MR 339 | Bergen Street Station

Summary: *Bergen Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Bergen Street Station is a below ground station with two side platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are located only at the center of the platforms along the platform edge. Column faces measure approximately 3'-8" from the platform edge. The platform widths are approximately 7-10" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the southbound control area of the station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

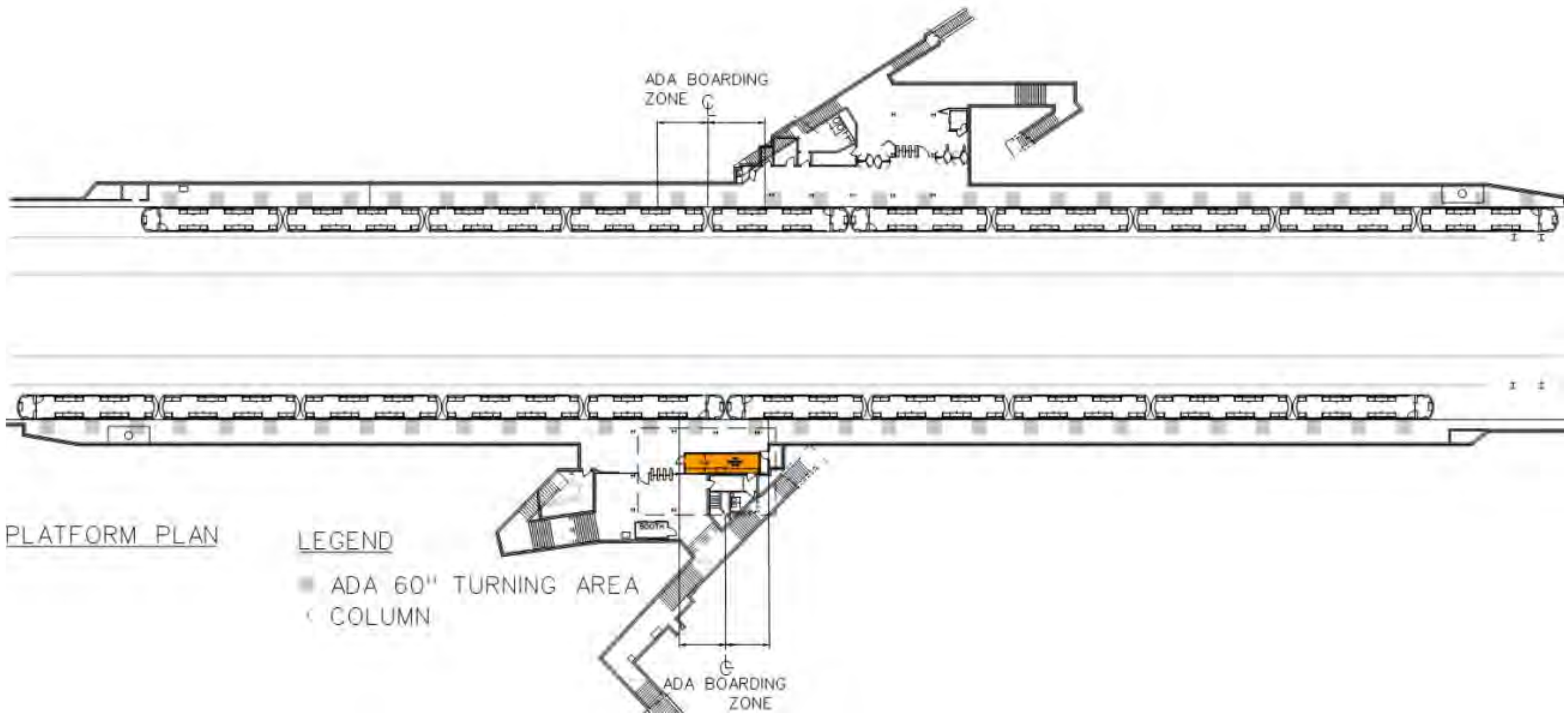

Figure 1 – *Overall Station Plan*
Bergen Street Station

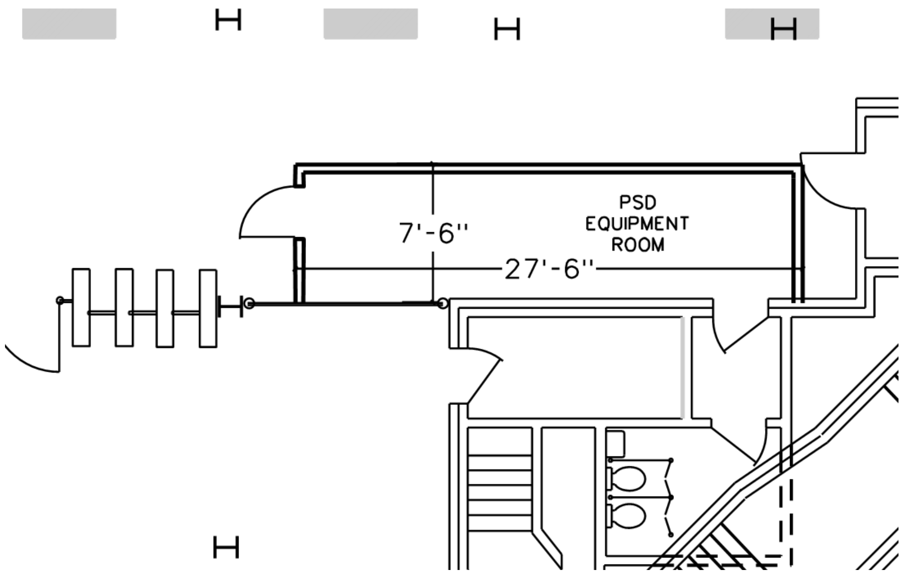

Figure 2 *– PSD Equipment Room 1 Detail*
Bergen Street Station

Figure 3 *– Typical platform view*
Bergen Street Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

The Reserve EDR was not accessible at the time of survey. However, the Normal electrical service has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (normal service)

Station Name	Bergen Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	40.8
Apparent Power (kVA)	51.0
Station Peak Demand Load, Max Current, (A)	141.7
Maximum Amount of Doors	40.0
PSD Total Load Including All Miscellaneous Loads, (A)	121.6
Total Load (Station Peak + PSD), (A)	263
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	537
Is Electrical Service Adequate?	**Yes**
Notes	Service capacity data is based on observations of breaker schedule.

***Table 1**. Normal Service Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $28.9M to install APGs and $33.3M to install PSDs (See Appendix E)

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1.28 – MR 340 | Grand Army Street Station

Summary: *Grand Army Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 29" (see figure 1).*

Description

The Grand Army Street Station is a below-grade station with one straight center/island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 32'-4" throughout. The corridor width at this station's western end is 44". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 29" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
Grand Army Plaza Station

1.29 – MR 341 | Eastern Parkway Brooklyn Street Station

Summary: *Eastern Parkway Brooklyn Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the northbound platform as the existing width is 5'-6" (see figure 1).*

Description

Eastern Parkway Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-6' to 11'-10".

Platform width at the ends of the platforms is 5'-6" or 66". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

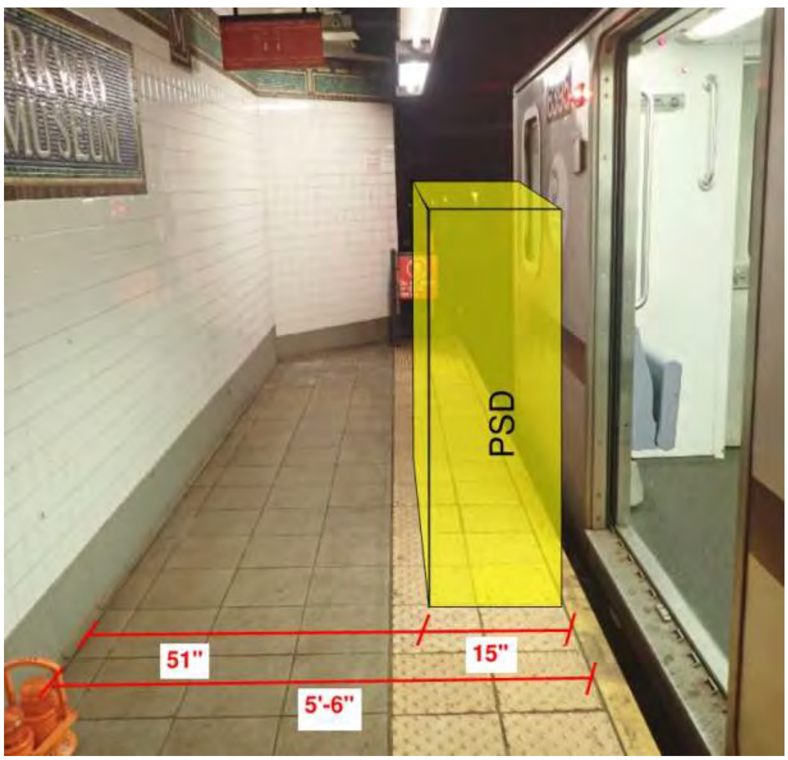

***Figure 1** – Non-Compliant egress condition*
Eastern Parkway Station

1.30 – MR 342 | Franklin Avenue Botanic Garden Station

Summary: *Franklin Avenue Botanic Garden Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Franklin Avenue Station is a below-grade station consisting of two center / island platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The column pictured in Figure 1 measures approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 16" from the edge*
Franklin Avenue Station

1.31 – MR 353 | President Street Station

Summary: *President Street is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at five platform stairs as the remaining width would be 27" (see figure 1).*

Description

President Street Station is a below-grade station with one straight center / island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 20'-0" throughout. The corridor width at southern end of this platform is 42". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 27" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
President Street Station

1.32 – MR 354 | Sterling Street Station

Summary: *Sterling Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power capacity could not be ascertained due to inaccessibility during survey. However, a lack of adequate existing power is not considered to be a determining factor of future feasibility.*

Description

Sterling Street Station is a below-grade station with two side platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are located throughout the length of the platforms along the platform edge. The platform widths are approximately 11-10” throughout. Ceiling heights measure no less than 7’-6” throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located in the station mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27’-6” x 7’-0”.

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges appear to be original to the station construction. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would be required for the installation of both an APG and PSD system.

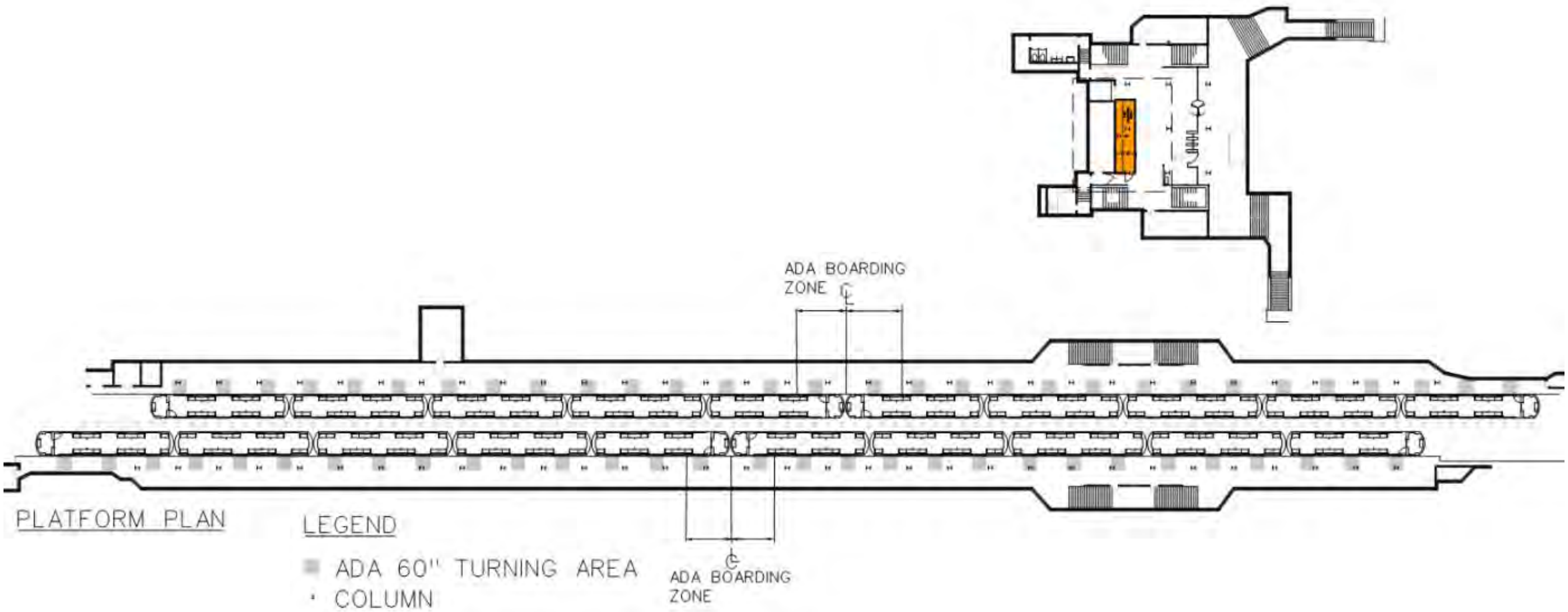

Figure 1 – Overall Station Plan
Sterling Street Station

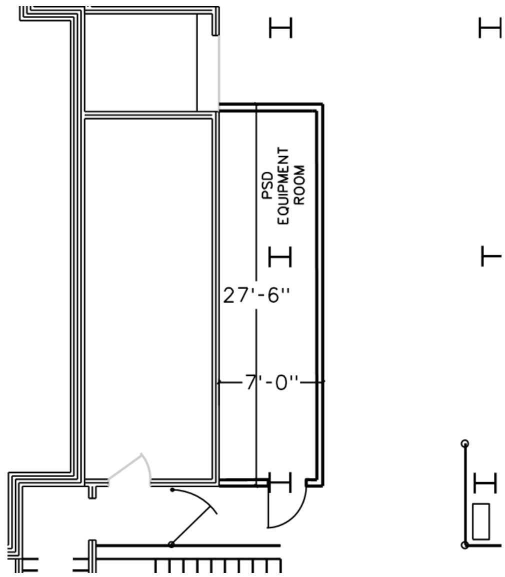

Figure 2 *– PSD Equipment Room 1 Detail*
Sterling Street Station

Figure 3 *– Typical platform view*
Sterling Street Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:
Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:
An analysis of adequate electrical power at this station could not be performed due to inaccessibility during survey. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $26.7M to install APGs and $33.4M to install PSDs (See Appendix E)

1.33 – MR 355 | Winthrop Street Station

Summary: *Winthrop Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 29" (see figure 1).*

Description

The Winthrop Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-8' to 11'-10". The corridor width at the southbound end of the platforms is 3'-8". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 29" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

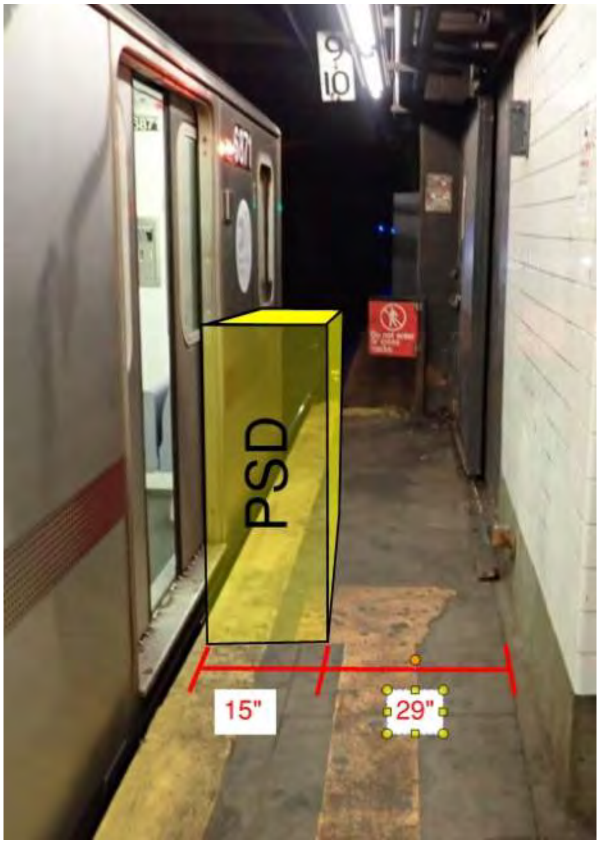

Figure 1 *– Non-compliant ADA condition*
Winthrop Street Station

1.34 – MR 356 | Church Avenue Station

Summary: *Church Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

Church Avenue Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns along each platform edge. The platform width varies from 7'-10" to 11'-10" throughout. Due to the extremely limited width of the existing platforms and control areas, there is no available space for the equipment room. Figure 2 below shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the southbound control area. The northbound control area is similar.

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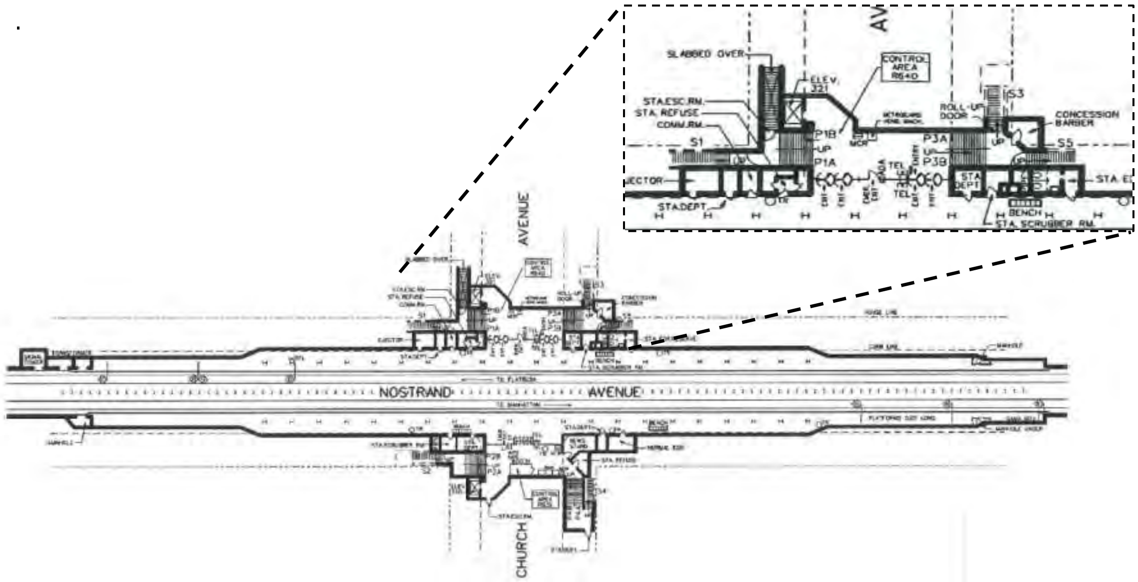

Figure 1 – Congested / Narrow Station Plan
Church Avenue Station

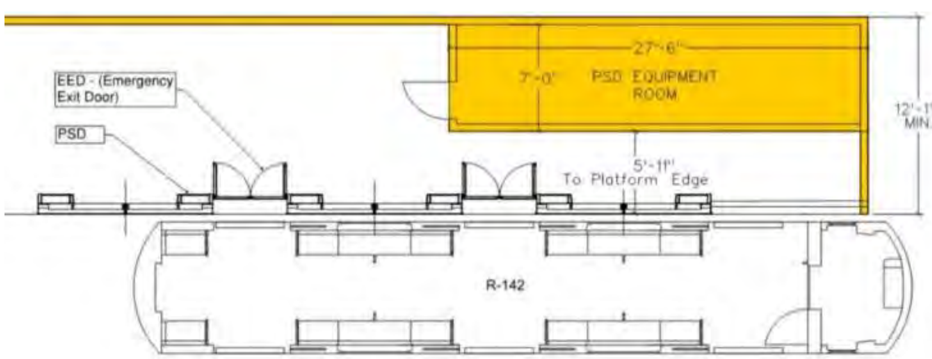

Figure 2 – Diagram demonstrating minimum platform width dimensions
Church Avenue Station

1.35 – MR 357 | Beverly Road Station

Summary: *Beverly Road Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the north end of the northbound platform as the existing width is 5'-9" (see figure 1).*

Description

Beverly Road Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-9' to 11'-10".

Platform width at the north end of the northbound platform is 5'-9" or 69". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

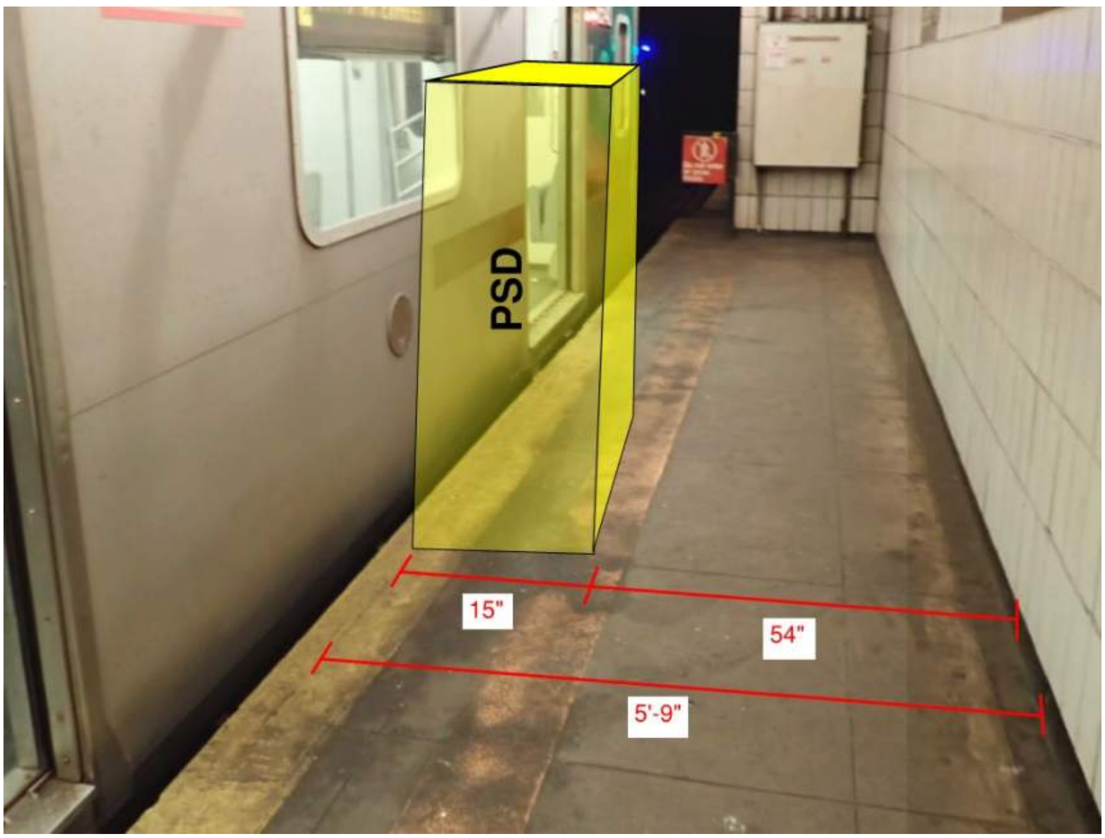

***Figure 1** – Non-Compliant egress condition*
Beverly Road Station

1.36 – MR 358 | Newkirk Avenue Station

Summary: *Newkirk Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the both platforms as the existing width is 5'-9" (see figure 1).*

Description

Newkirk Avenue Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-9' to 11'-10".

Platform width at the ends of the northbound & southbound platform are 5'-9" or 69". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

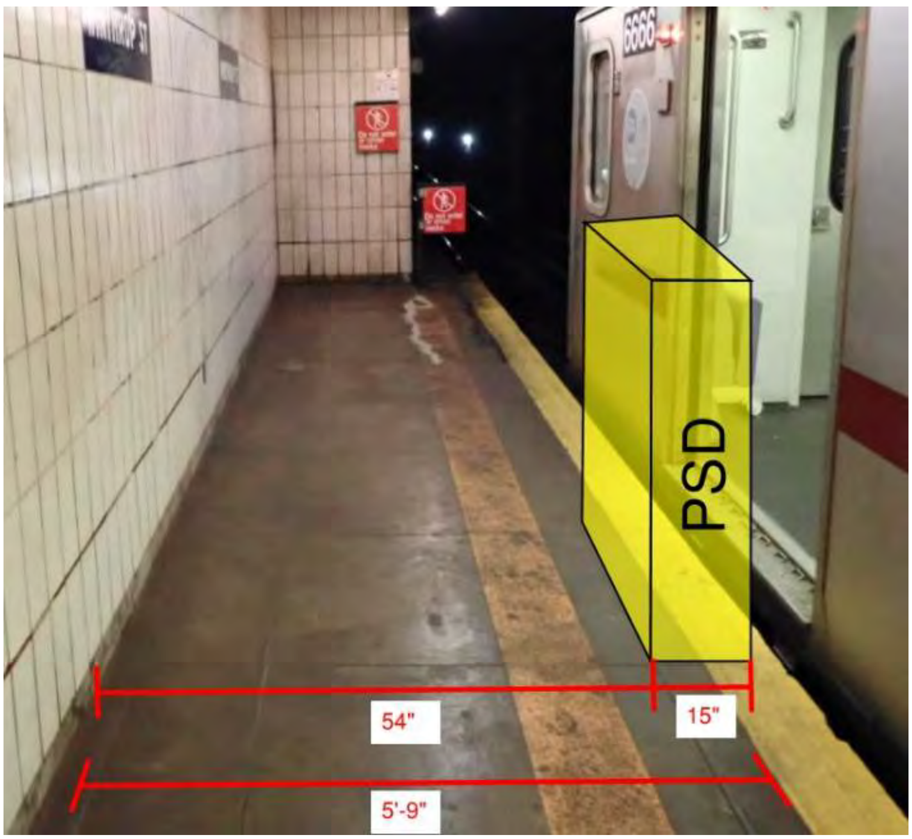

Figure 1 *– Non-Compliant egress condition*
Newkirk Avenue Station

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1.37 – MR 359 | Flatbush Avenue Brooklyn College Station

Summary: *Flatbush Avenue Brooklyn College Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 13" (see figure 1).*

Description

The Flatbush Avenue Brooklyn College Station is a below-grade terminus station with two straight side platforms. The platform structures are cast-in-place concrete. The corridor width at the northern end of the northbound platform is 2'-4". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 13" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Area of ADA non-compliance*
Flatbush Avenue Brooklyn College Station

1.38 – MR 416 | 241st Street Wakefield Station

Summary: *241st Street Wakefield is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The 241st Street Station is an elevated terminus station with two closed side platforms and one open center/island platform. The platform structures are precast concrete. The width of the center platform is approximately 15'-0" throughout. The platform is straight with one row of columns supporting its respective station canopies. This station is also infeasible due to non-compliant ADA dimensions at south end of the platforms, where the existing 30" of width will be reduced to 15" with the installation of PSDs. See figure 1 & 2 for reference.

Figure 1 *– Non-compliant ADA Condition*
241st Street Station

Figure 2 *– Precast Slab*
241st Street Station

1.39 – MR 417 | 238th Street Nereid Avenue Station

Summary: *238th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The 238th Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 12'-0" to 12'-4". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

***Figure 1** – General Station Condition*
238th Street Station

***Figure 2** – Precast Slab*
238th Street Station

1.40 – MR 418 | 233rd Street Station

Summary: *233rd Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The 233rd Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 12'-0" to 12'-6". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
233rd Street Station

Figure 2 *– Precast Slab*
233rd Street Station

1.41 – MR 419 | 225th Street Station

Summary: *225th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The 225th Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 12'-0" throughout. The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
225th Street Station

Figure 2 *– Precast Slab*
225th Street Station

1.42 – MR 420 | 219th Street Station

***Summary:** 219th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The 219th Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 12'-0" to 12'-4". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

***Figure 1** – General Station Condition*
219th Street Station

***Figure 2** – Precast Slab*
219th Street Station

1.43 – MR 421 | Gun Hill Road Station

Summary: *Gun Hill Road Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Gun Hill Road Station is an elevated station with two center / island platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 14’-0” to 16’-8”. The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Gun Hill Road Station

Figure 2 *– Precast Slab*
Gun Hill Road Station

1.44 – MR 422 | Burke Avenue Station

Summary: *Burke Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Burke Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 12'-2" to 12'-4". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

***Figure 1** – General Station Condition*
Burke Avenue Station

***Figure 2** – Precast Slab*
Burke Avenue Station

1.45 – MR 423 | Allerton Avenue Station

Summary: *Allerton Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Allerton Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 12'-0" to 12'-6". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Allerton Avenue Station

Figure 2 *– Precast Slab*
Allerton Avenue Station

1.46 – MR 424 | Pelham Parkway Station

Summary: *Pelham Parkway Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Pelham Parkway Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 12'-8" to 13'-10". The platforms are straight with cantilevered beams supporting their respective station canopies. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Pelham Parkway Station

Figure 2 *– Precast Slab*
Pelham Parkway Station

1.47 – MR 425 | Bronx Park East Station

Summary: *Bronx Park East Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Bronx Park East Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 12’-0” to 12’-6”. The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Bronx Park East Station

Figure 2 *– Precast Slab*
Bronx Park East Station

1.48 – MR 426 | East 180th Street Morris Pk Station

***Summary:** East 180th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The East 180th Street Station is an elevated station with two center / island platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 16'-6" to 16'-8". The platforms are straight with two rows of columns supporting their respective station canopies See figure 1 & 2 for reference.

***Figure 1** – General Station Condition*
East 180th Street Station

***Figure 2** – Precast Slab*
East 180th Street Station

1.49 – MR 427 | West Farm Sq. / E. Tremont Ave Station

Summary: *West Farms Square Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The West Farms Square Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 13'-8" to 13'-10". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
West Farms Square Station

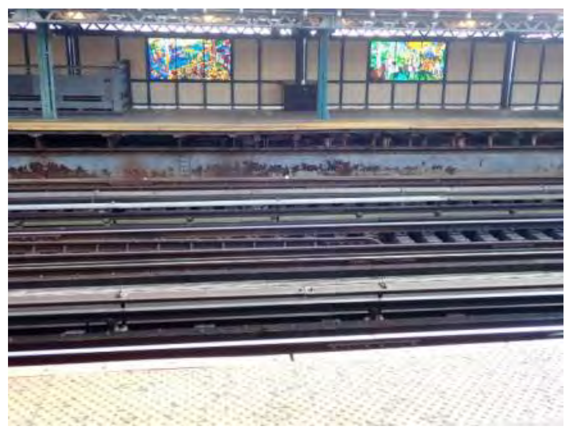


Figure 2 *– Precast Slab*
West Farms Square Station

1.50 – MR 428| 174th Street Station

Summary: *174th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The 174th Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 7'-8" to 12'-4". The platforms are mildly curved with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

***Figure 1** – General Station Condition*
174th Street Station

***Figure 2** – Precast Slab*
174th Street Station

1.51 – MR 429 | Freeman Street Station

Summary: *Freeman Street is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Freeman Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 7'-0" to 13'-8". The platforms are mildly curved with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

***Figure 1** – General Station Condition*
Freeman Street Station

***Figure 2** – Precast Slab*
Freeman Street Station

1.52 – MR 430 | Simpson Street Station

Summary: *Simpson Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Simpson Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 6'-0" to 13'-10". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Simpson Street Station

Figure 2 *– Precast Slab*
Simpson Street Station

1.53 – MR 431 | Intervale Avenue Station

Summary: *Intervale Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Intervale Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 6'-0" to 13'-10". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

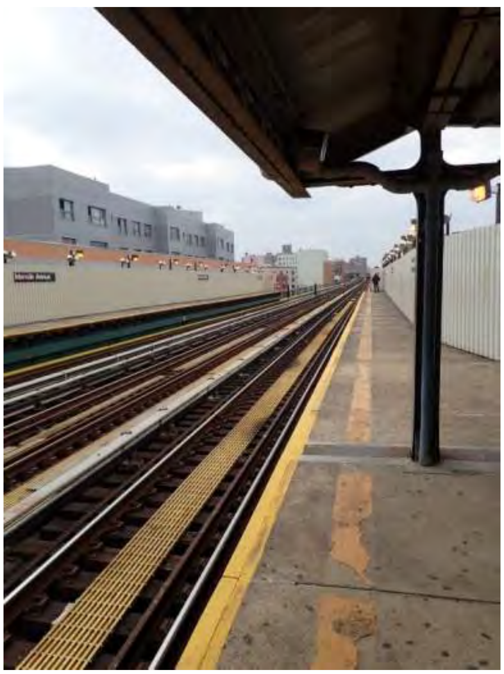


Figure 1 *– General Station Condition*
Intervale Avenue Station

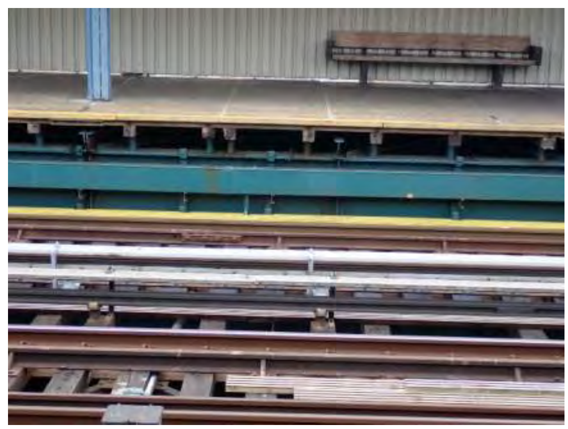


Figure 2 *– Precast Slab*
Intervale Avenue Station

1.54 – MR 432 | Prospect Avenue Station

Summary: *Prospect Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Prospect Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 7'-4" to 14'-4". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Prospect Avenue Station

Figure 2 *– Precast Slab*
Prospect Avenue Station

1.55 – MR 433 | Jackson Avenue Station

Summary: *Jackson Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Jackson Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 6'-6" to 14'-0". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Jackson Avenue Station

Figure 2 *– Precast Slab*
Jackson Avenue Station

1.56 – MR 434 | 3rd Avenue 149th Street Station

Summary: *3rd Avenue 149th Street Station is not feasible for both APGs and PSDs as the columns which are located 18" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

3rd Avenue 149th Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 18" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 18" from the edge*
3rd Avenue 149th Street Station

1.57 – MR 435 | 149th Street Grand Concourse Station

Summary: *149th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 35" (see figure 1).*

Description

The 149th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The corridor width at the western ends of the platforms is 4'-2". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 35" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
149th Street Station

1.58 – MR 438 | 135th Street Station

Summary: *135th Street Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

135th Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

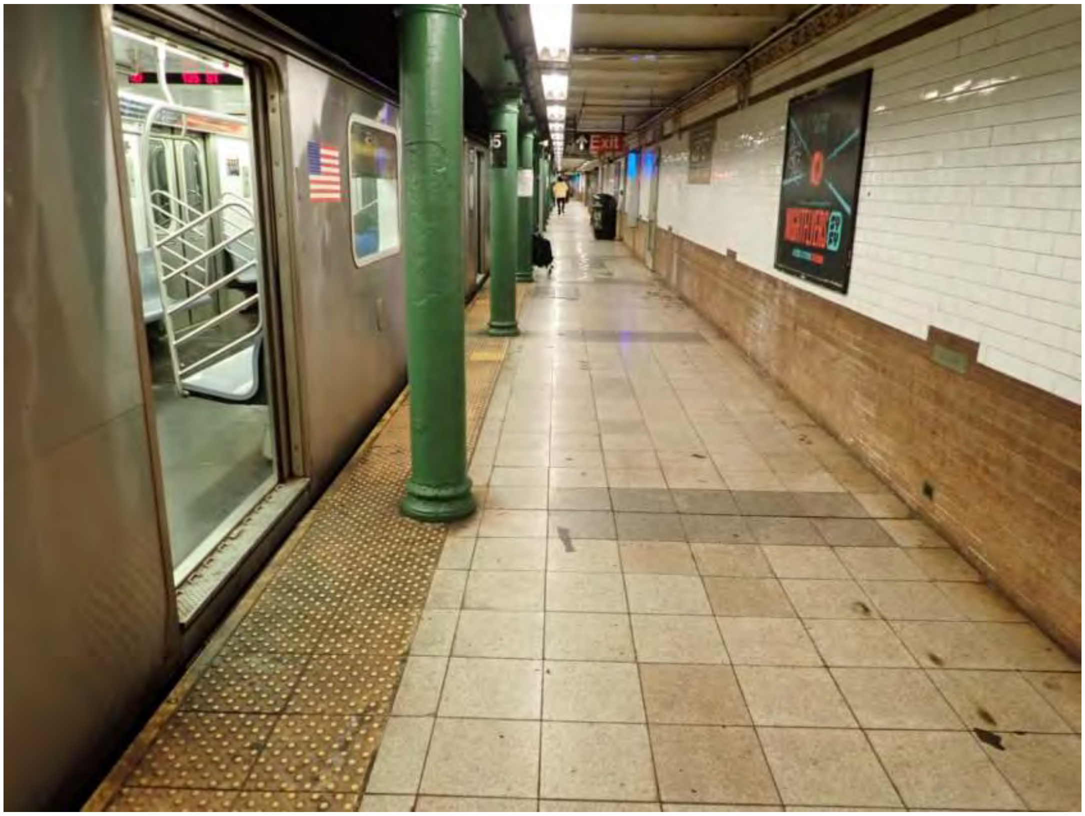


Figure 1 – *Column 16" from the edge*
135th Street Station

1.59 – MR 439 | 125th Street Station

Summary: *125th Street Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

125th Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 16" from the edge*
125th Street Station

1.60 – MR 440 | 116th Street Station

Summary: *116th Street Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

116th Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 16" from the edge*
116th Street Station

1.61 – MR 441 | 110th Street Central Park North Station

Summary: *110th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the northbound platform as the existing width is 5'-0" (see figure 1).*

Description

110th Street Station is a below-grade station with one center/island platform. The platform structure is cast-in-place concrete. The width of the corridors at this station ranges from 5'-0' to 21'-6".

The corridor width at the center of this platform adjacent to the control area is constrained to o 5'-0" or 60". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

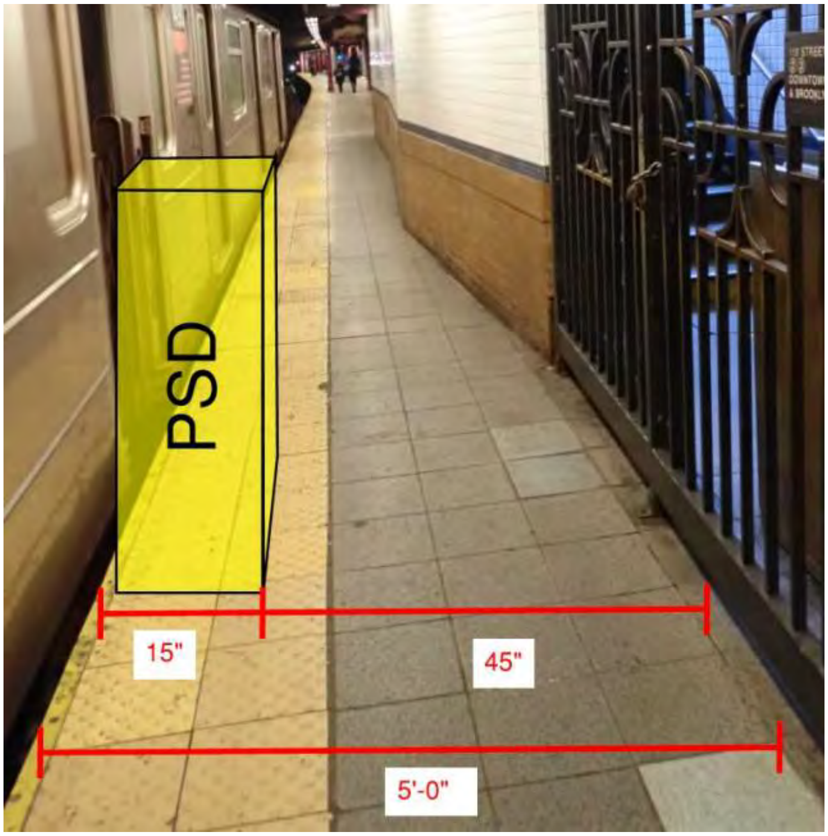


Figure 1 *– Non-Compliant egress condition*
110th Street Station

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for <u>Tier 2 Stations'</u> screening will include the following:*
>
> *a. Column location in relation to the platform edge*
> *b. Platform edge clearance adjacent to stairs and other impediments*
> *c. Impacts to ADA path of travel and boarding areas*
> *d. Conflicts of PSD/APG/RPSDs with Signals cables*
> *e. Sufficient platform width*
> *f. Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for <u>Tier 3 Stations</u> will include the following:*
>
> *a. Structural capacity of platforms to accept PSD/APG/RPSDs*
> *b. Feasibility & location for PSD/APG/RPSDs equipment room*
> *c. Confirmation of adequate power for PSD/APG/RPSDs*
> *d. Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> *e. Determination of communications requirements, availability and cost*
> *f. Determination of gap detection and entrapment avoidance technology requirements*
> *g. Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
   - Double the amount of motors as PSDs (each motor operating a single leaf).
   - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
   - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
   - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY. Status of doors will be provided to crew via indicator lights, with no automated propulsion cutout.

If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

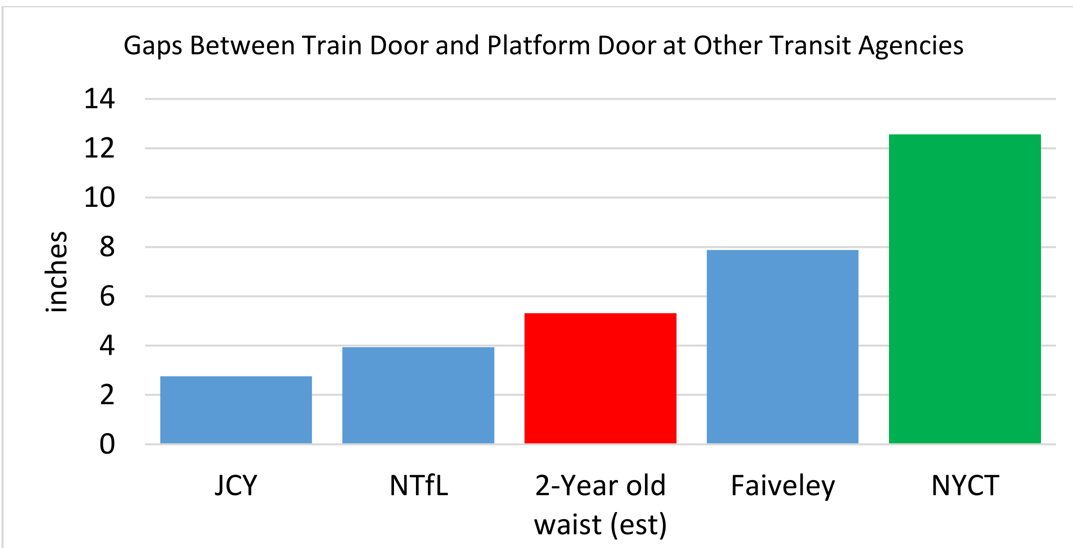


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

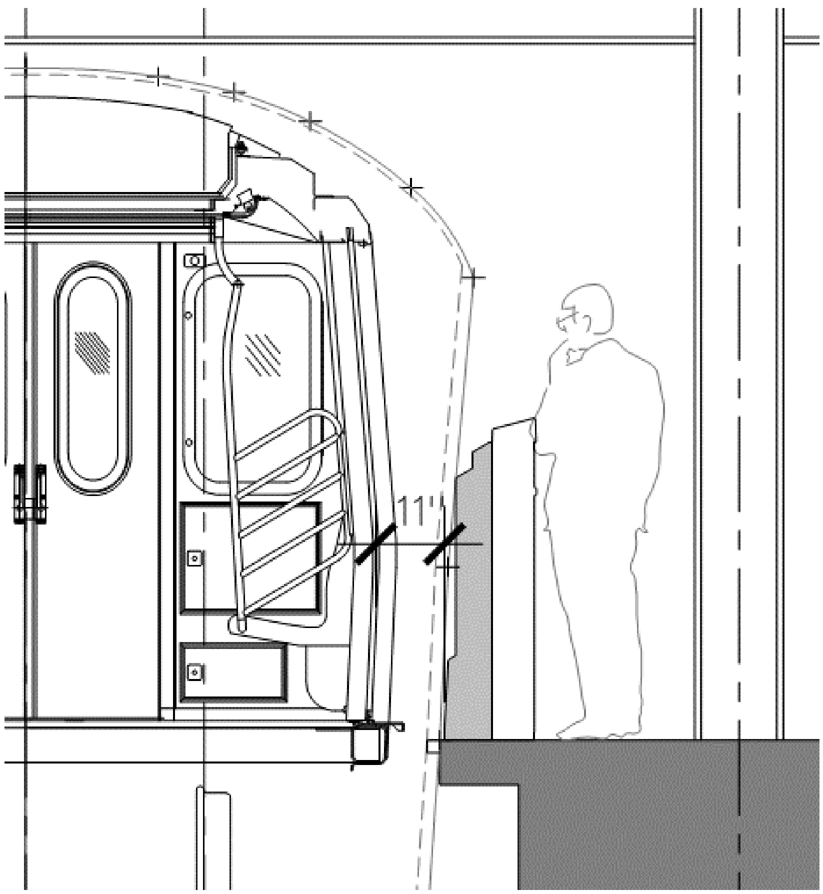


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber “bumpers” on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6” into the line equipment envelope. This would leave a 5” gap between the platform and car doors allowing approximately 2” of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5" by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor's window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor's window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **<u>bold/underline</u>**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	**PSD System 1**	**PSD System 2**	**PSD System 3**
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are "existing" as defined by code. All the rolling stock is also to be considered "existing" under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60" radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36" of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

304 Turning Space

304.1 General. Turning space shall comply with 304.

304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.

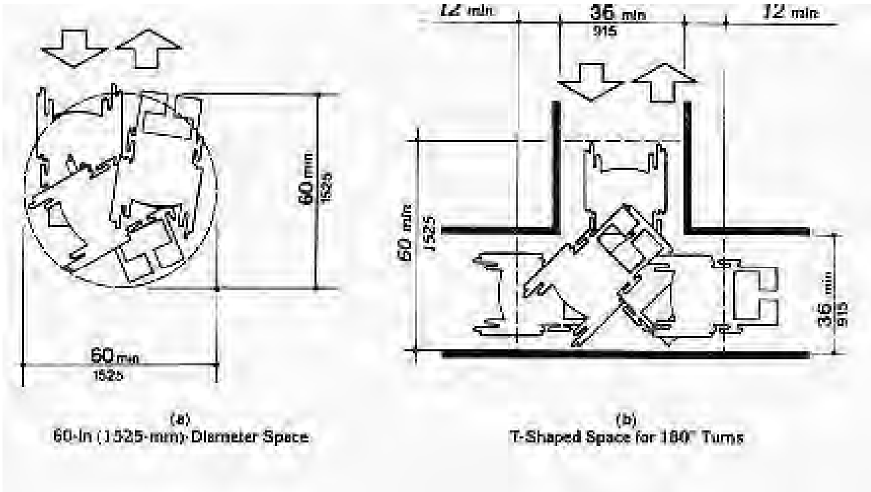
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

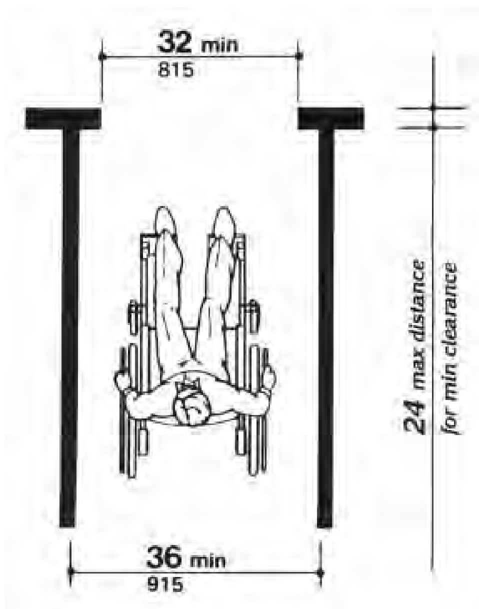


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

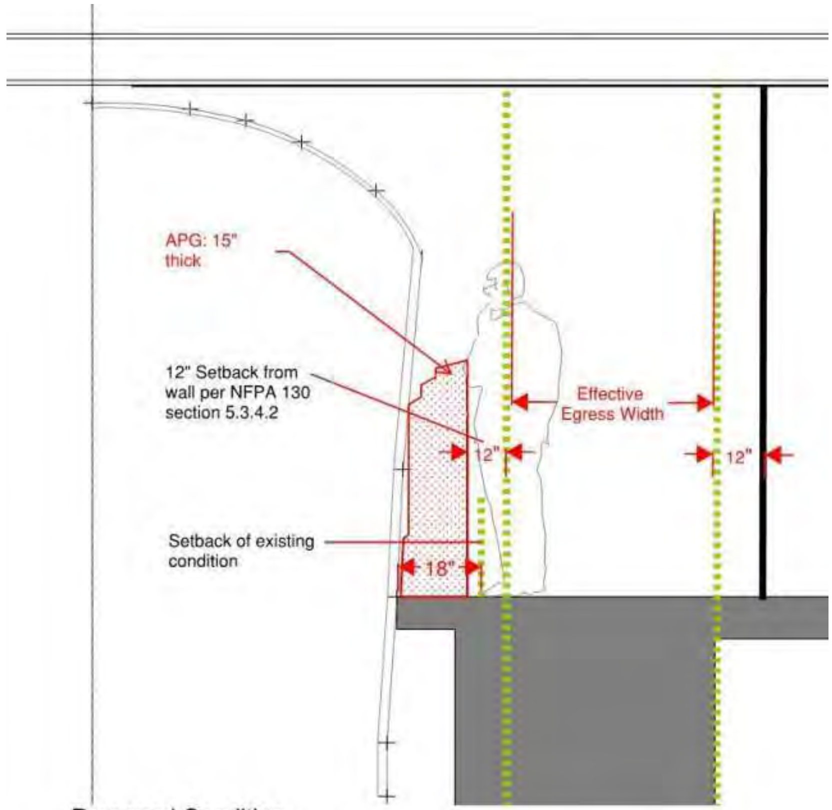
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15" of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

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Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

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Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	**Dedicated Loop**	**Wayside Only**
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	**CBTC**		**Dedicated loop**		**Wayside only**	
		Qty.	**subtotal**	**Qty.**	**subtotal**	**Qty.**	**subtotal**
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

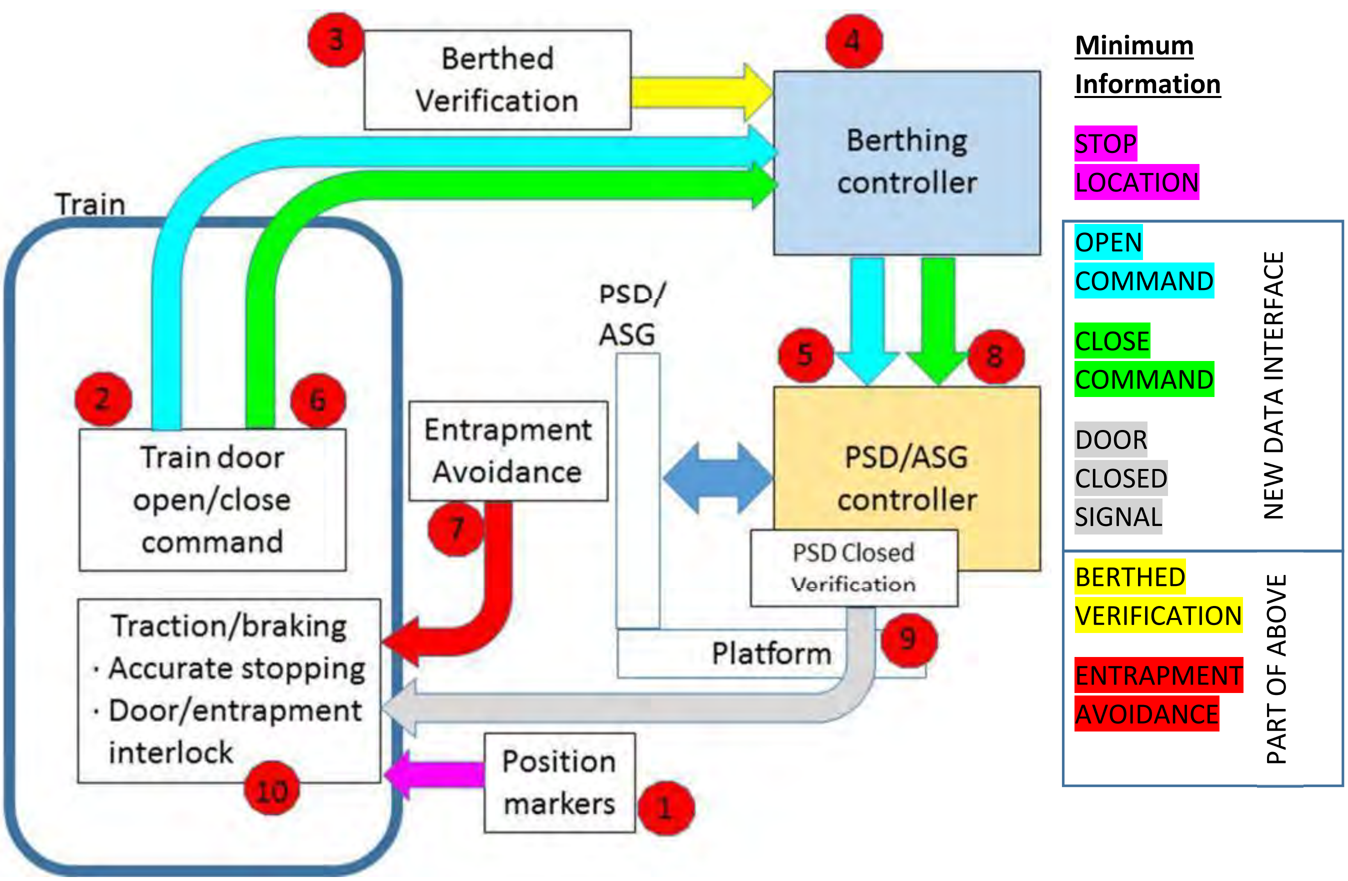
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

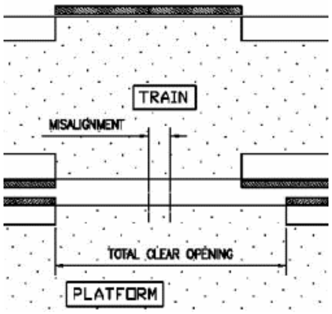
C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5" clear opening, a design for NY should meet the ADA Accessibility Guideline of 36".

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a 'distance totem' which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy's COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically

If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.

For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4'-0"). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

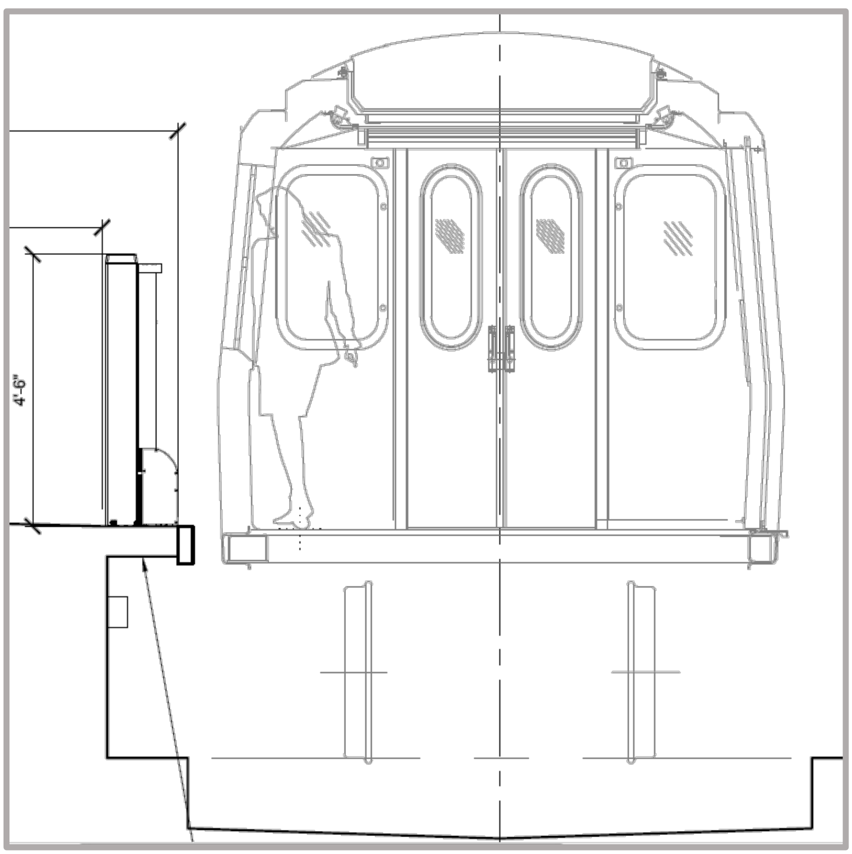


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1’-2” over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

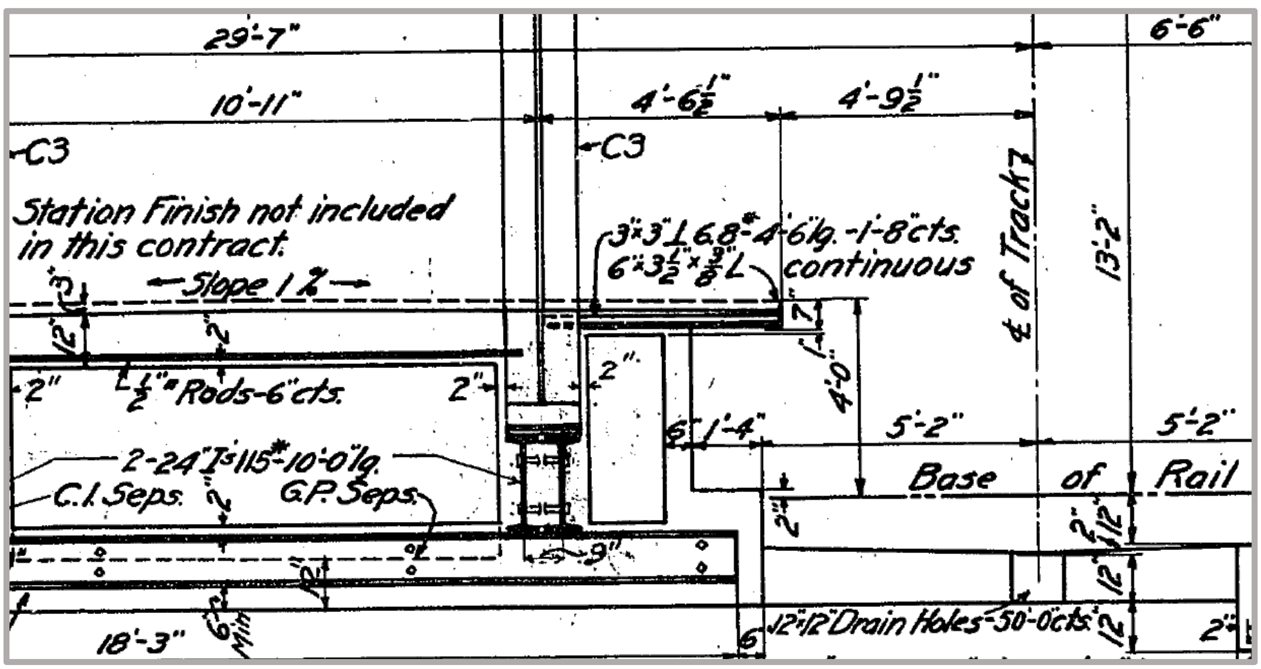


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; “2” & “5” Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6” thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1’-2” long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

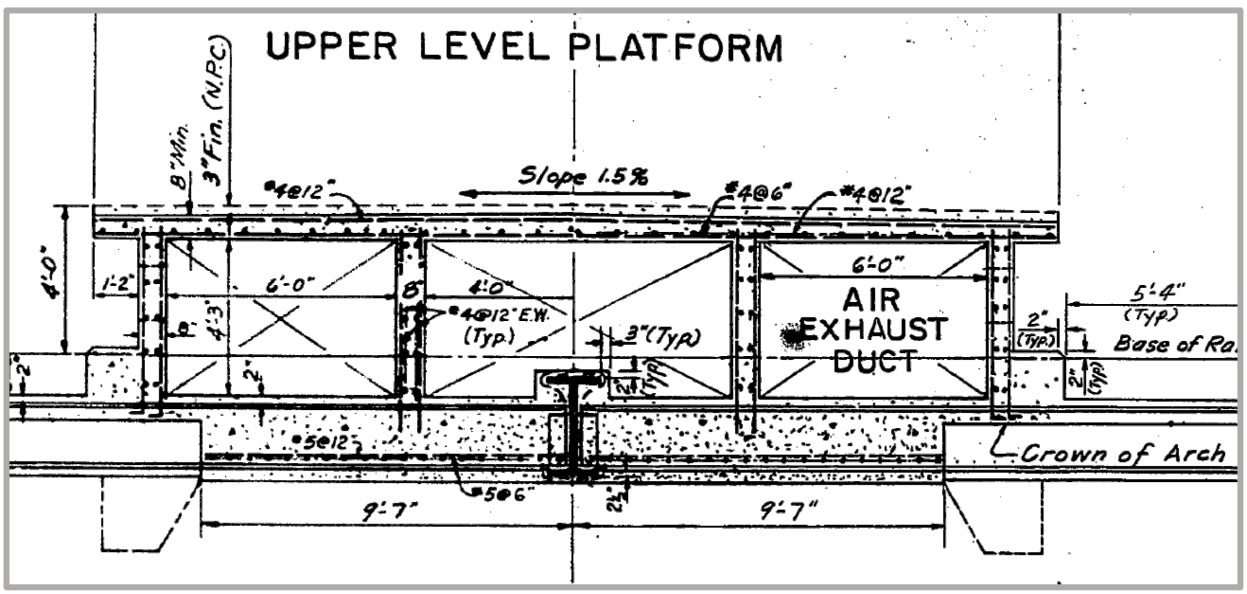


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; “E”, “J”, and “Z” trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

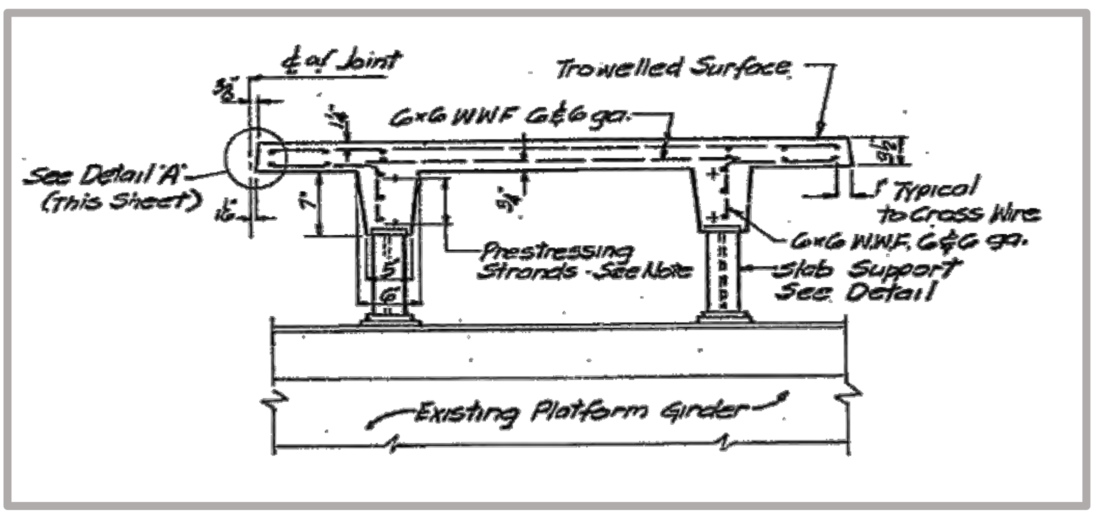


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

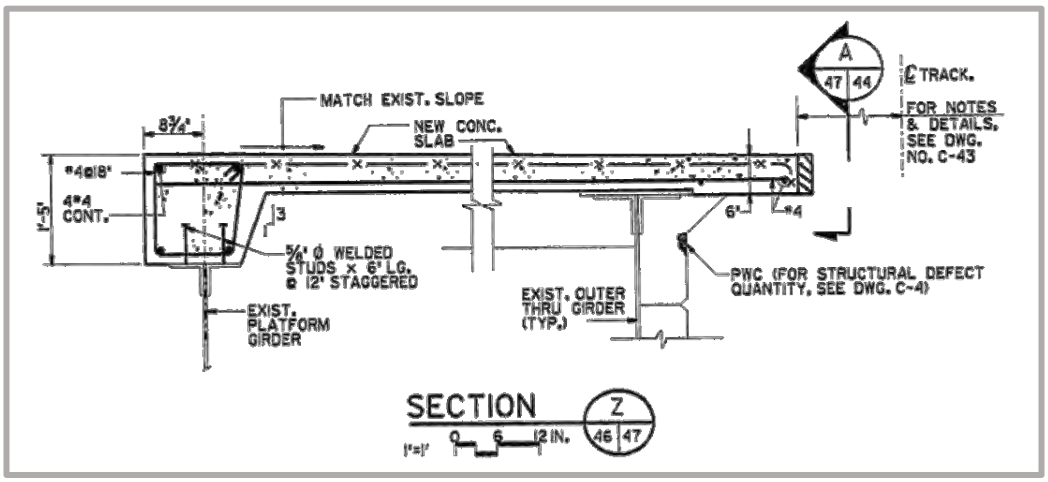


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2'-9"), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

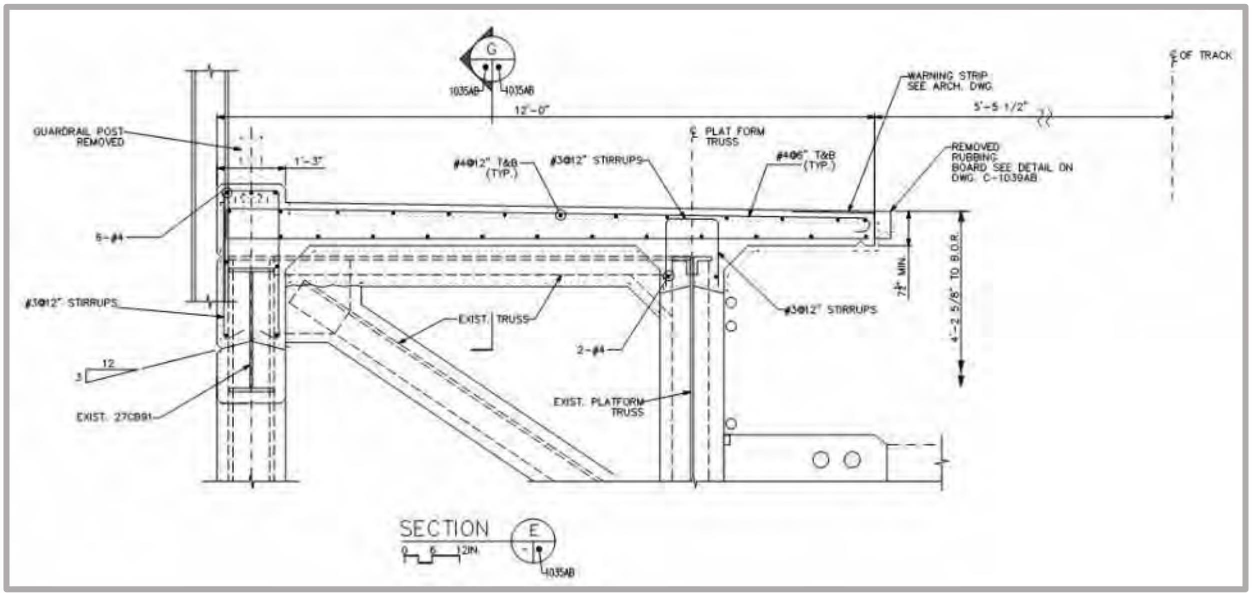


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3" thick structural slab with an approximately 3" thick topping slab. If the topping slab is fully removed, a 6" thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6" thick slab will be sufficient for a cantilever length of up to approximately 3'-0", greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6" structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6" minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

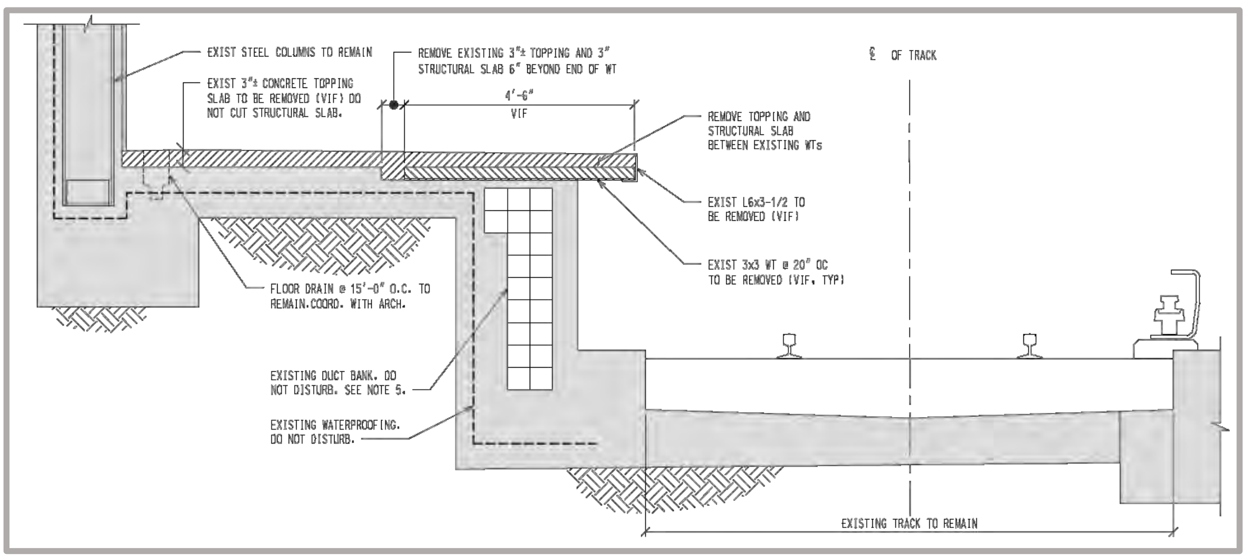


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

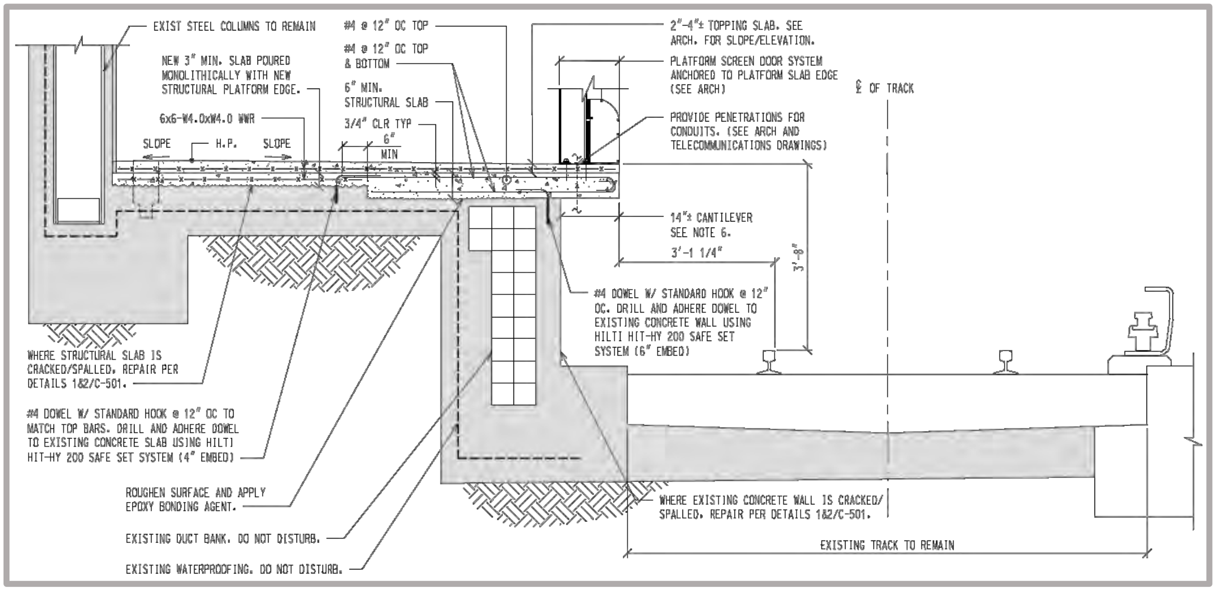


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

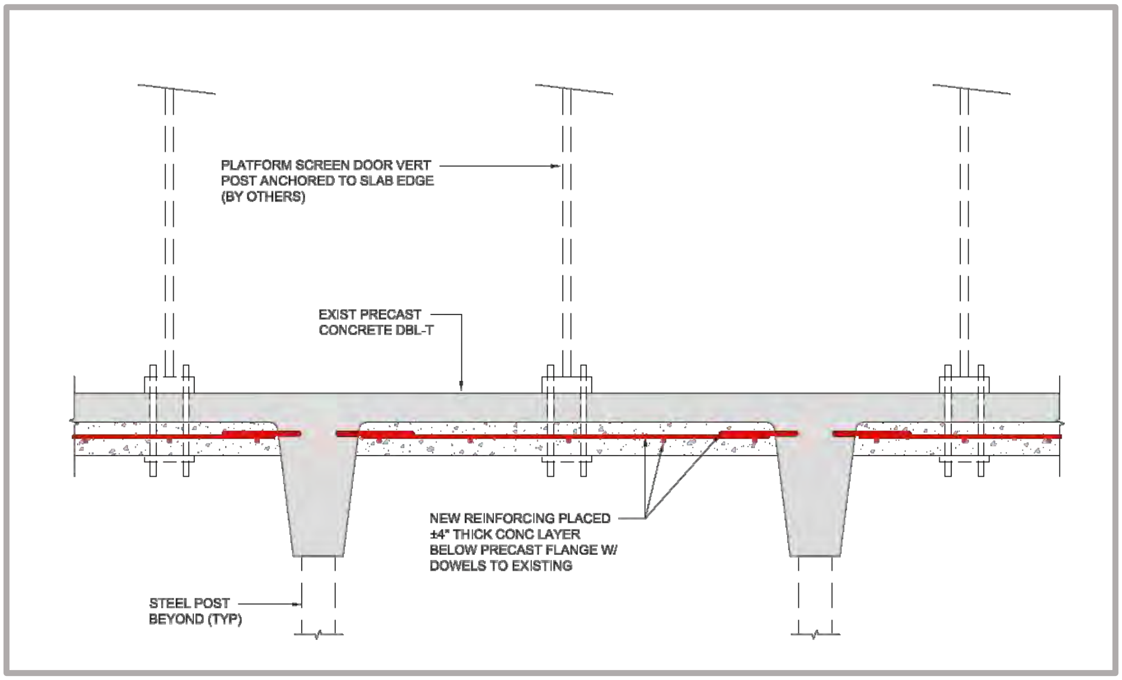


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5’ – 11” of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis

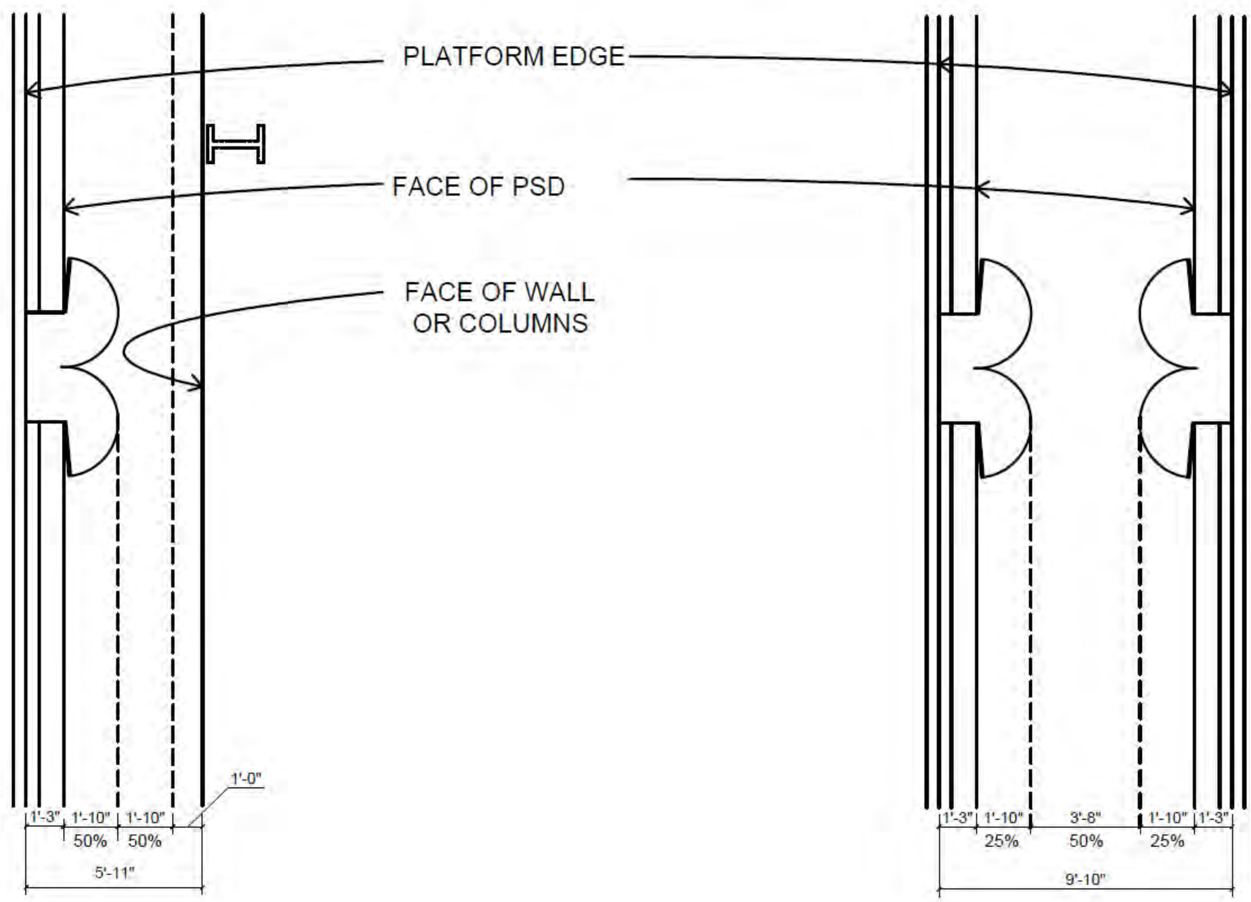


FIGURE 1: SIDE PLATFORM

FIGURE 2: CENTER PLATFORM

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

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MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE		EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800	per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the	9	$ 63,500	per month [Year 01]	$ 571,500		
	platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance	12	$ 83,590	per month [Year 02]	$ 1,003,080		
	since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	12	$ 65,683	per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000	per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5					
	Materials and labor for preventative maintenance and	12	$ 68,310	per month [Year 04]	$ 819,724		$ 819,724
	remedial repair performed as needed, 24/7, for the	12	$ 71,043	per month [Year 05]	$ 852,513		$ 852,513
	platform screen door system and ancillary equipment.						
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5					
	Repair and Replacement of Defective Hardware	24	$ 6,350	per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880	per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220	per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500	per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10					
	Repair and Replacement of Defective Hardware	60	$ 9,525	per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920	per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230	per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750	per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15					
	Repair and Replacement of Defective Hardware	60	$ 12,700	per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200	per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240	per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000	per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20					
	Repair and Replacement of Defective Hardware	60	$ 15,875	per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500	per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250	per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500	per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:		$ 6,078,826	$ 6,078,826	$ 7,619,663
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:		$ 7,619,663		

7	Labor Bill Rate (per hour)	Year 1	$ 238	per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248	per hour *	
		Year 3	$ 257	per hour *	
	Optional :	Year 4	$ 268	per hour *	
	Optional :	Year 5	$ 278	per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

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ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations
ESTIMATE DATE:	February 20, 2019

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VJ ASSOCIATES
ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

MTA/NYCT

February 20, 2019

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.2 *APGs / PSDs will provide 29 emergency egress doors with push bars per platform*
1.3 *Each platform edge will have 40 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 It is assumed that each train has 10 cars on this line
2.2 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.3 In respect of the PSD option, only platforms that have not been upgraded in the recent past will require platform edge replacement.
2.4 There are no special security requirements made necessary by installation of the APG system
2.5 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.6 This estimate does not provide for the replacement of Platform Edge Lighting
2.7 Premium cost for night time work is considered 50% of total labor cost

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VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

MTA/NYCT

February 20, 2019

BASIS OF ESTIMATE

3.0 ***Exclusions - Costs not included in the estimate:***

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems
3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length
3.4 Costs associated with NYCT State Of Good Repair improvements to the station
3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.
3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs
3.7 Escalation Cost is not included; Anticipate at 5% per annum.
3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.
3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium
3.10 NYCT project cost is not included
3.11 GO and flagging cost is not included
3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or “soft” costs:***

4.1 Design and Construction Contingency
4.2 Contractor O & P
4.3 Insurance
4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 Given the limited time available, no drawings were developed to support this estimate.

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MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations
February 20, 2019

ORDER OF MAGNITUDE COSTS			MRN 339	MRN 354	MRN 324	MRN 325	MRN 326
DESCRIPTION			BERGEN STREET	STERLING STREET	HOUSTON STREET	CANAL STREET	FRANKLIN STREET
1	AUTOMATIC PLATFORM GATES (APG'S)		$14,242,796	$14,178,075	$14,432,734	$14,654,238	$14,378,070
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$14,242,796	$14,178,075	$14,432,734	$14,654,238	$14,378,070
4	GENERAL REQUIREMENTS	15.00%	$2,136,419	$2,126,711	$2,164,910	$2,198,136	$2,156,710
	SUB-TOTAL:		$16,379,215	$16,304,787	$16,597,644	$16,852,373	$16,534,780
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,094,804	$4,076,197	$4,149,411	$4,213,093	$4,133,695
	SUB-TOTAL:		$20,474,019	$20,380,983	$20,747,054	$21,065,466	$20,668,475
6	OVERHEAD & PROFIT	15.00%	$3,071,103	$3,057,147	$3,112,058	$3,159,820	$3,100,271
	SUB-TOTAL:		$23,545,122	$23,438,131	$23,859,113	$24,225,286	$23,768,747
7	BONDS & INSURANCE	3.75%	$882,942	$878,930	$894,717	$908,448	$891,328
	SUB-TOTAL:		$24,428,064	$24,317,061	$24,753,829	$25,133,735	$24,660,075
	SUBTOTAL CONSTRUCTION COST W/O ACM		**$24,428,064**	**$24,317,061**	**$24,753,829**	**$25,133,735**	**$24,660,075**
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		**$24,428,064**	**$24,317,061**	**$24,753,829**	**$25,133,735**	**$24,660,075**
10	DESIGN CONSULTANT FEES	10.00%	$2,442,806	$2,431,706	$2,475,383	$2,513,373	$2,466,007
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		**$26,870,870**	**$26,748,767**	**$27,229,212**	**$27,647,108**	**$27,126,082**
	ADD ALTERNATIVES						
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		3,383,096	3,534,070	3,692,464	4,075,068	3,472,144
	Add for Markups (as above)	88.66%	2,999,551	3,133,408	3,273,846	3,613,073	3,078,503
	SUB-TOTAL PSD ALTERNATIVE		**$6,382,646**	**$6,667,478**	**$6,966,310**	**$7,688,141**	**$6,550,647**
	TOTAL PROJECT COST (PSD OPTION)		**$33,253,516**	**$33,416,245**	**$34,195,522**	**$35,335,249**	**$33,676,730**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : HOUSTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	526	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	526	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,052**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,052	LF	7	7,364
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,260	SF	12	63,120
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	106	CY	2,500	265,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,054	EA	25	26,350
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,054	EA	25	26,350
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,052	LF	95	99,940
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,052	LF	15	15,780
26	Remove existing platform tiles	1,052	LF	12	12,624
27	Sawcut existing topping concrete at perimeter of removal area	1,052	LF	5	5,260
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,312	SF	8	50,496
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10' wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,052	SF	15	15,780

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : HOUSTON STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,259	SF	750	1,694,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	197,715	197,715
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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STATION : HOUSTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,052	LF	60	63,120
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	400	LF	60	24,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	450	LF	60	27,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : HOUSTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,330,631	3,330,631
112					
113	TOTAL PSD WORK:				$ 14,432,734
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,750	SF	750	3,562,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	363,857	363,857
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	70,029
129	L6x6x1/2 continuous angle	8	TONS	17,500	135,498
130	Drilling and bolting - 4 bolts at each connection	421	EA	216	90,893
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	40	HRS	162	6,480
137	Remove signal cables	300	LF	40	12,000
138	Remove conduit; Assuming 1"	300	LF	55	16,500
139	Install conduit in new position	300	LF	110	33,000
140	Install replacement cable; assumed single cable #12	300	LF	125	37,500
141	Re-commission / testing as required	1	EA	12,500	12,500
142	Engineering / Shop Drawings / Etc.	1	EA	7,500	7,500
143	Premium Time	785	HRS	49	38,151
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : HOUSTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,259)	SF	750	(1,694,250)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	197,715	(197,715)
152	Platform Edge Reconstruction work	(1)	LS	496,020	(496,020)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,052)	LF	30	(31,560)
155					
156	Allow loss of production to work at night say 50%	1	LS	852,107	852,107
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 3,692,464

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : CANAL STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	546	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	555	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,101**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,101	LF	7	7,707
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,505	SF	12	66,060
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	111	CY	2,500	277,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,103	EA	25	27,575
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,103	EA	25	27,575
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,101	LF	95	104,595
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,101	LF	15	16,515
26	Remove existing platform tiles	1,101	LF	12	13,212
27	Sawcut existing topping concrete at perimeter of removal area	1,101	LF	5	5,505
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,606	SF	8	52,848
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10' wide strip	506	SF	8	4,051
30	New Work				
31	New concrete topping to match existing	1,101	SF	15	16,515

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : CANAL STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	506	SF	15	7,596
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,480	SF	750	1,859,625
61	Spare Parts - Approx. 10% of Material Cost	1	LS	207,638	207,638
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : CANAL STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,101	LF	60	66,060
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : CANAL STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,381,747	3,381,747
112					
113	TOTAL PSD WORK:				$ 14,654,238
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,142	SF	750	3,856,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	381,497	381,497
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	73,230
129	L6x6x1/2 continuous angle	8	TONS	17,500	141,809
130	Drilling and bolting - 4 bolts at each connection	440	EA	216	95,126
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	80	HRS	162	12,960
137	Remove signal cables	600	LF	40	24,000
138	Remove conduit; Assuming 1"	600	LF	55	33,000
139	Install conduit in new position	600	LF	110	66,000
140	Install replacement cable; assumed single cable #12	600	LF	125	75,000
141	Re-commission / testing as required	2	EA	12,500	25,000
142	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
143	Premium Time	1,569	HRS	49	76,253
144					

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : CANAL STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,480)	SF	750	(1,859,625)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	207,638	(207,638)
152	Platform Edge Reconstruction work	(1)	LS	513,910	(513,910)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,101)	LF	30	(33,030)
155					
156	Allow loss of production to work at night say 50%	1	LS	940,400	940,400
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				**$ 4,075,068**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : FRANKLIN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	525	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	525	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,050**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,050	LF	7	7,350
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,250	SF	12	63,000
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	106	CY	2,500	265,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,052	EA	25	26,300
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,052	EA	25	26,300
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,050	LF	95	99,750
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,050	LF	15	15,750
26	Remove existing platform tiles	1,050	LF	12	12,600
27	Sawcut existing topping concrete at perimeter of removal area	1,050	LF	5	5,250
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,300	SF	8	50,400
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-0" wide strip	560	SF	8	4,480
30	New Work				
31	New concrete topping to match existing	1,050	SF	15	15,750

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : FRANKLIN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	560	SF	15	8,400
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
61	Spare Parts - Approx. 10% of Material Cost	1	LS	197,310	197,310
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : FRANKLIN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,050	LF	60	63,000
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : FRANKLIN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,318,016	3,318,016
112					
113	TOTAL PSD WORK:				$ 14,378,070
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,734	SF	750	3,550,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	363,137	363,137
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	69,899
129	L6x6x1/2 continuous angle	8	TONS	17,500	135,240
130	Drilling and bolting - 4 bolts at each connection	420	EA	216	90,720
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : FRANKLIN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,250)	SF	750	(1,687,500)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	197,310	(197,310)
152	Platform Edge Reconstruction work	(1)	LS	495,800	(495,800)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,050)	LF	30	(31,500)
155					
156	Allow loss of production to work at night say 50%	1	LS	801,264	801,264
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				**$ 3,472,144**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : BERGEN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	512	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	512	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,024**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,024	LF	7	7,168
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,120	SF	12	61,440
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	103	CY	2,500	257,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,026	EA	25	25,650
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,026	EA	25	25,650
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,024	LF	95	97,280
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,024	LF	15	15,360
26	Remove existing platform tiles	1,024	LF	12	12,288
27	Sawcut existing topping concrete at perimeter of removal area	1,024	LF	5	5,120
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,144	SF	8	49,152
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-0" wide strip	560	SF	8	4,480
30	New Work				
31	New concrete topping to match existing	1,024	SF	15	15,360

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STATION : BERGEN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	560	SF	15	8,400
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,133	SF	750	1,599,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	192,045	192,045
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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STATION : BERGEN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,024	LF	60	61,440
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	200	LF	60	12,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : BERGEN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,286,799	3,286,799
112					
113	TOTAL PSD WORK:				$ 14,242,796
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,526	SF	750	3,394,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	353,777	353,777
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	68,200
129	L6x6x1/2 continuous angle	8	TONS	17,500	131,891
130	Drilling and bolting - 4 bolts at each connection	410	EA	216	88,474
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : BERGEN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,133)	SF	750	(1,599,750)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	192,045	(192,045)
152	Platform Edge Reconstruction work	(1)	LS	485,440	(485,440)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,024)	LF	30	(30,720)
155					
156	Allow loss of production to work at night say 50%	1	LS	780,714	780,714
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 3,383,096

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : STERLING STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	507	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	507	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,014**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,014	LF	7	7,098
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,070	SF	12	60,840
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	102	CY	2,500	255,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,016	EA	25	25,400
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,016	EA	25	25,400
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,014	LF	95	96,330
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,014	LF	15	15,210
26	Remove existing platform tiles	1,014	LF	12	12,168
27	Sawcut existing topping concrete at perimeter of removal area	1,014	LF	5	5,070
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,084	SF	8	48,672
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-0" wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,014	SF	15	15,210

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : STERLING STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,088	SF	750	1,566,000
61	Spare Parts - Approx. 10% of Material Cost	1	LS	190,020	190,020
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : STERLING STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,014	LF	60	60,840
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : STERLING STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,271,864	3,271,864
112					
113	TOTAL PSD WORK:				$ 14,178,075
115					
116	**ADD ALTERNATIVE**				
117					
118	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
119					
120	**ADD**				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,446	SF	750	3,334,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	350,177	350,177
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	67,547
129	L6x6x1/2 continuous angle	7	TONS	17,500	130,603
130	Drilling and bolting - 4 bolts at each connection	406	EA	216	87,610
131	Platform Edge Repair				
132	Remove concrete platform edge	1,014	LF	27	27,378
133	Platform edge repair	1,014	LF	109	110,526
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	496	EA	10	4,960
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

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MTA/NYCT

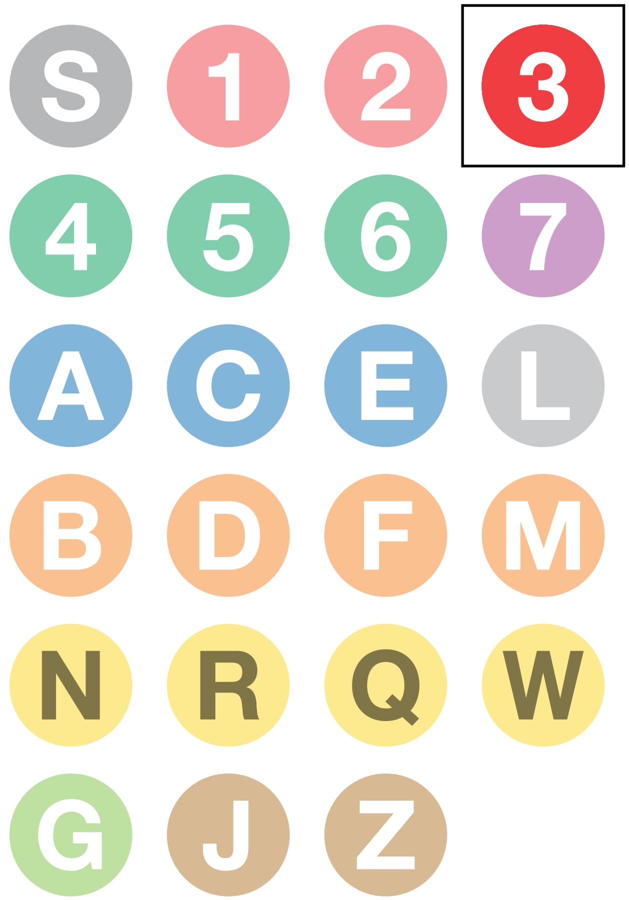
Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-2 Line Stations

20-Feb-19

STATION : STERLING STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,088)	SF	750	(1,566,000)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	190,020	(190,020)
152	Platform Edge Reconstruction work	(1)	LS	481,840	(481,840)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,014)	LF	30	(30,420)
155					
156	Allow loss of production to work at night say 50%	1	LS	815,555	815,555
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 3,534,070

MTA New York City Transit



REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR '3' SERVICE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

FINAL SUBMITTAL DATE: April 3, 2019

STV 100 Years

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<u>Appendices</u>
Appendix A- Tier 2-3 Technology Assessment
Appendix B- Structural Feasibility
Appendix C- Emergency Egress Width Analysis
Appendix D- Maintenance Cost Estimates
Appendix E- ROM Cost Estimates

Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. Our Tier 1 analysis found no instances of door misalignment between car classes for this line. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 34 newly evaluated stations, 33 have been found to be not suitable for the installation of PSDs.

[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to half-height barriers]

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues: the platform edge barriers are 15" wide. Where an existing object (wall, stair, and railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Under the following conditions, PSDs are declared infeasible:
  - Limit the ability of a wheelchair to turn within a 5'-0" circle
  - Limit path of travel to less than a 32" pinch width (defined as an obstruction that measures less than 2'-0" longitudinally, i.e. columns)
  - Limit path of travel to be less than a 36" corridor as defined by the edge of a staircase, railing or room
- Insufficient space for the PSD equipment room: the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow: due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements regarding the placement of these new barriers in an existing station environment.
- Structural considerations: existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.

- Columns at platform edge: at certain stations, the columns are positioned 16" to 24" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space.

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the previously proposed 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the PSD barriers and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is used for refuse removal at twenty-seven of the 3-line stations. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the (off) loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in damage from these carts along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 3% of the '3' Line stations. Total implementation cost would be $26.9M for APGs and $33.2M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; that estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of $931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 1 feasible station, the aggregate annual maintenance cost would be $931,000.

Summary Table

(3% Feasible 1/34)

No.	Station Names	Station Type	Platform Type	Feasibility	Issues/Reason for Failure	Cost APGs	Cost PSDs
310	96th Street	SUB	Island	No	ADA Clearance	-	-
313	72nd Street	SUB	Island	No	ADA Clearance	-	-
317	42nd St. Times Square	SUB	Island	No	ADA Clearance	-	-
318	34th Street Penn Station	SUB	Island	No	ADA Clearance	-	-
322	14th Street	SUB	Island	No	Non-Compliant Egress Path	-	-
327	Chambers St.	SUB	Island	No	ADA Clearance	-	-
331	Park Place	SUB	Island	No	ADA Clearance	-	-
332	Fulton St.	SUB	Island	No	ADA Clearance	-	-
333	Wall Street	SUB	Island	No	ADA Clearance	-	-
334	Clark Street Bridge	SUB	Island	No	ADA Clearance	-	-
335	Borough Hall	SUB	Side	No	ADA Clearance	-	-
336	Hoyt Street	SUB	Side	No	ADA Clearance	-	-
337	Nevins Street	SUB	Island	No	Columns too close to edge	-	-
338	Atlantic Avenue Barclay Ctr.-	SUB	Side	No	ADA Clearance	-	-
339	Bergen Street	SUB	Side	Yes	-	$26.9M	$33.2M
340	Grand Army Plaza	SUB	Island	No	ADA Clearance	-	-
341	Eastern Parkway	SUB	Side	No	Non-Compliant Egress Path	-	-
342	Franklin Avenue Botanic Garden	SUB	Island	No	Columns too close to edge	-	-
343	Nostrand Avenue Eastern Pkwy	SUB	Side	No	No PSD Room Location	-	-
344	Kingston Avenue	SUB	Side	No	No PSD Room Location	-	-
345	Crown Heights Utica Ave.	SUB	Island	No	Columns too close to edge	-	-
346	Sutter Ave.	ELV	Side	No	Precast Platform	-	-
347	Saratoga Avenue	ELV	Side	No	Precast Platform	-	-
348	Rockaway Avenue	ELV	Side	No	Precast Platform	-	-
349	Junius Street	ELV	Side	No	Precast Platform	-	-
350	Pennsylvania Avenue	ELV	Side	No	Precast Platform	-	-
351	Van Siclen Avenue	ELV	Side	No	Precast Platform	-	-
352	New Lots Avenue	ELV	Side	No	Precast Platform	-	-
436	148th Street Harlem	SUB	Island	No	ADA Clearance	-	-
437	145th Street	SUB	Side	No	Non-Compliant Egress Path	-	-
438	135th Street	SUB	Side	No	Columns too close to edge	-	-
439	125th Street	SUB	Side	No	Columns too close to edge	-	-
440	116th Street	SUB	Side	No	Columns too close to edge	-	-
441	110th Street Central Park North	SUB	Island	No	Non-Compliant Egress Path	-	-
					Totals	$26.9M	$33.2M

1.0 Station Assessments

1.01 – MR 310 | 96th Street Station

Summary: *96th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 31" (see figure 1).*

Description

The 96th Street Station is a below-grade station with two straight center/ island platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 13'-6' to 17'-8". The corridor width at this station's elevators is 46". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 31" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-compliant ADA condition*
96th Street Station

1.02 – MR 313 | 72nd Street Station

Summary: *72nd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met at five platform stairs as the remaining width would be 15" (see figure 1).*

Description

The 72nd Street Station is a below-grade station with two straight center / island platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 15'-6". The corridor width at the platform stairs is 30". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 15" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

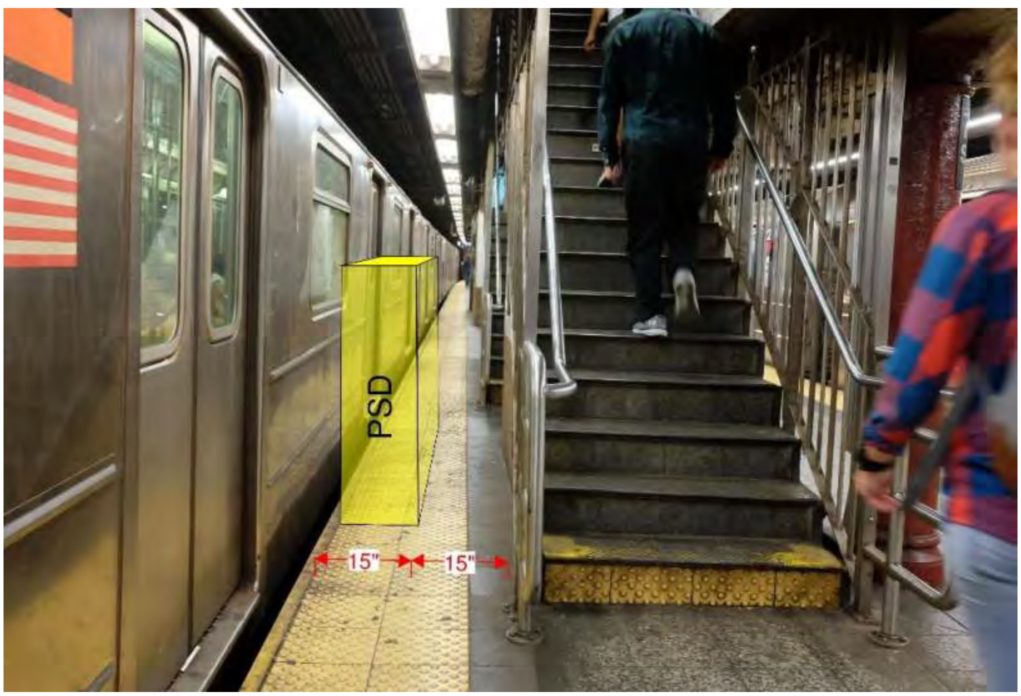

***Figure 1** – Non-compliant ADA condition*
72nd Street Station

1.03 – MR 317 | 42nd Street / Times Square Station

Summary: *42nd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at the south end of the platform as the remaining width would be 27" (see figure 1).*

Description

The 42nd Street Station is a below-grade station consisting two center / island platforms. The platforms are approximately 21'-2" wide throughout. At the southern end of the northbound platform there are 42" between the column and the platform edge. The implementation of a platform edge barrier would reduce this width to 27" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
42nd Street Station

1.04 – MR 318 | 34th Street Penn Station

Summary: *34th Street Penn Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the southbound platform as the existing width is 5'-0" (see figure 1).*

Description

34th Street Station is a below-grade station consisting of both side and center / island platform. The express 2 and 3 trains utilize the center / island platform. The platform is approximately 24'-8"' wide throughout, narrowing to 5'-0" at the south end of the southbound platform and 5'-3" at the northbound platform. Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress via emergency exit doors with an installed PSD system. See figure 1 for reference.

***Figure 1** – Non-Compliant egress condition*
34th Street Station

1.05 – MR 322 | 14th Street Station

Summary: *14th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the northbound platform as the existing width is 5'-0"" (see figure 1).*

Description

14th Street Station is a below-grade station with two straight center/ island platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-0' to 19'-4".

Platform width at the southern end of both platforms is 5'-0" or 60". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

***Figure 1** – Non-Compliant egress condition*
14th Street Station

1.06 – MR 327 | Chambers Street Station

Summary: *Chambers Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 31" (see figure 1).*

Description

The Chambers Street Station is a below-grade station with two straight center / island platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 17'-2". The corridor width at the southern end of the southbound platform is 46". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 31" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
Chambers Street Station

1.07 – MR 331 | Park Place Station

Summary: *Park Place Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at the escalator as the remaining width would be 23" (see figure 1).*

Description

The Park Place Station is a below-grade station with one straight center / island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 17'-10". At the columns on either side of the escalator, there is 38" clearance. The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 23" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
Park Place Station

1.08 – MR 332 | Fulton St. Station

Summary: *Fulton St. Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 31" (see figure 1).*

Description

The Fulton Street Station is a below-grade station with one straight center / island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 13'-6" throughout. At the south end of the southbound platform, the existing clearance is 46". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 31" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
Fulton Street Station

1.09 – MR 333 | Wall Street Station

Summary: *Wall Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 17" (see figure 1).*

Description

The Wall Street Station is a below-grade station with one center / island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 14'-0", narrowing to 6'-6" at the end. At several of the stairs, the existing clearance is 32". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 17" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

It is also not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-compliant ADA condition*
Wall Street Station

1.10 – MR 334 | Clark Street Station

Summary: *Clark Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 9" (see figure 1)..*

Description

Clark Street Station is a below-grade station with one center / Island platform. The platform structure is cast in place concrete. The width of the platform is approximately 15'-6. At the two stairs, columns flanking the stairs leave 24" of clearance. The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 9" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
Clark Street Station

1.11 – MR 335 | Borough Hall Station

Summary: *Borough Hall Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 23" (see figure 1).*

Description

Borough Hall Station is a below-grade station with two straight side platforms. The platform structures are cast in place concrete. The width of the platforms varies from 3'-2" to 11'- 8". At the south end of the southbound platform the corridor width to the platform wall is only 3'-2". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 23" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

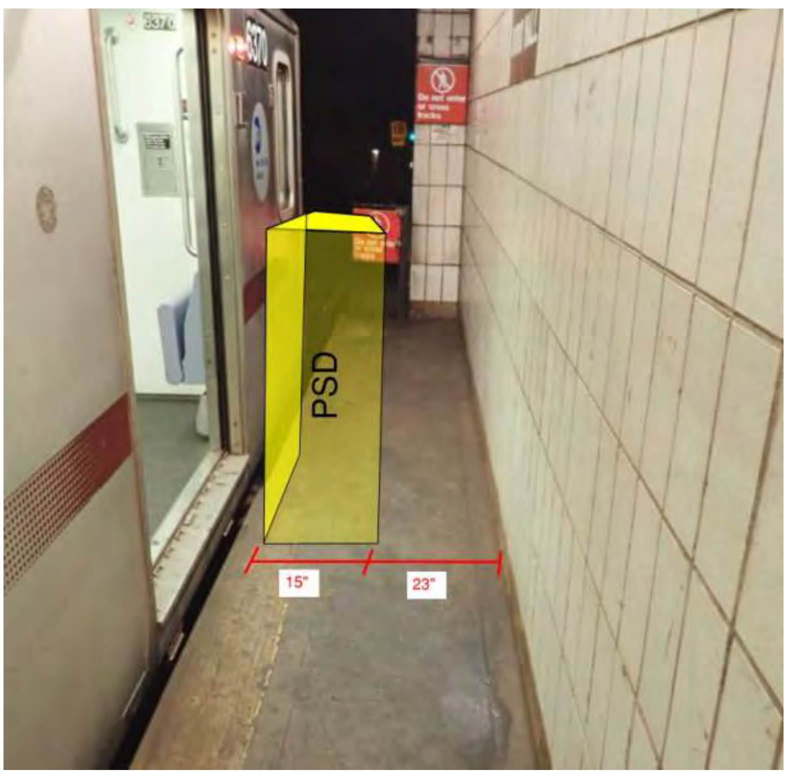

Figure 1 *– Non-compliant ADA condition*
Borough Hall Station

1.12 – MR 336 | Hoyt Street Station

Summary: *Hoyt Street Station is not feasible for both APGs and PSDs. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at the north end of the northbound as the remaining width would be 19" (see figure 1)..*

Description

Hoyt Street Station is a below-grade station with two straight side platforms. The platform structures are cast in place concrete. The width of the platforms varies from 11'-0" to 13'- 0, and narrows at the ends. At the north end of the northbound platform, the existing clearance at the columns is 34". The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 19" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

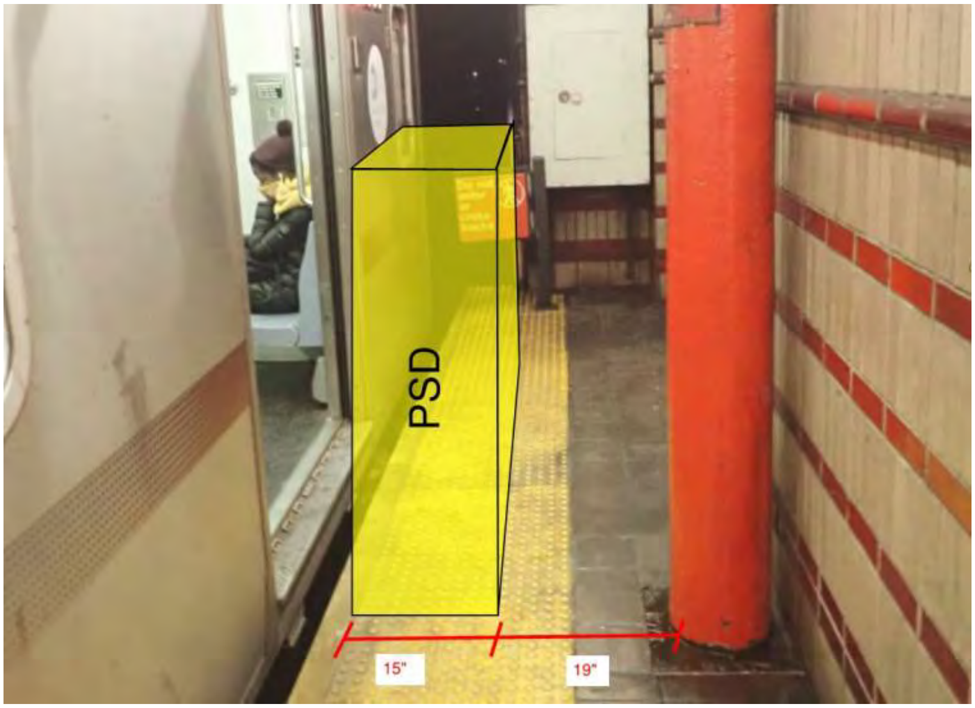

Figure 1 *– Non-compliant ADA condition*
Hoyt Street Station

1.13 – MR 337 | Nevins Street Station

Summary: *Nevins Street Station is not feasible for both APGs and PSDs as the columns which are located 20" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description

Nevins Street Station is a below-grade station with two center / island platforms. The platform structures are cast-in-place concrete. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 20" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios

Figure 1 *– Columns at 20" from platform edge*
Nevins Street Station

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1.14 – MR 338 | Atlantic Avenue Barclay Ctr Station

Summary: *Atlantic Avenue Barclay Ctr. Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 21" (see figure 1).*

Description

The Atlantic Avenue Barclay Ctr. Station is a below-grade station with two straight side platforms and a center / island platform. The 3 trains stop at the side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 6'-8' to 18'-0". The corridor width at the staircase at the south end of the southbound platform is 36". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 21" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

The non-compliant condition noted above could be remedied by moving the stopping location of the train. The proposal to move the stopping position of trains in specific stations would need to be studied by NYCT Signals Engineering to determine the impact to signals and signals equipment between that station and a series of adjacent stations all the way to the nearest interlocking. In many cases signals equipment at several locations would need to be relocated and rewired. The only way to fully determine this is to make an analysis of the existing signals system in that area.

Since that type of task is outside the scope of the PSD Feasibility Study, it is concluded that the current train stopping position is fixed. Given this condition, the ADA and/or Code analysis is being used for the feasibility analysis.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
Atlantic Ave Station

1.15 – MR 339 | Bergen Street Station

Summary: *Bergen Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Bergen Street Station is a below-grade station with two side platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are located only at the center of the platforms along the platform edge. Column faces measure approximately 3'-8" from the platform edge. The platform widths are approximately 7-10" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the southbound control area of the station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

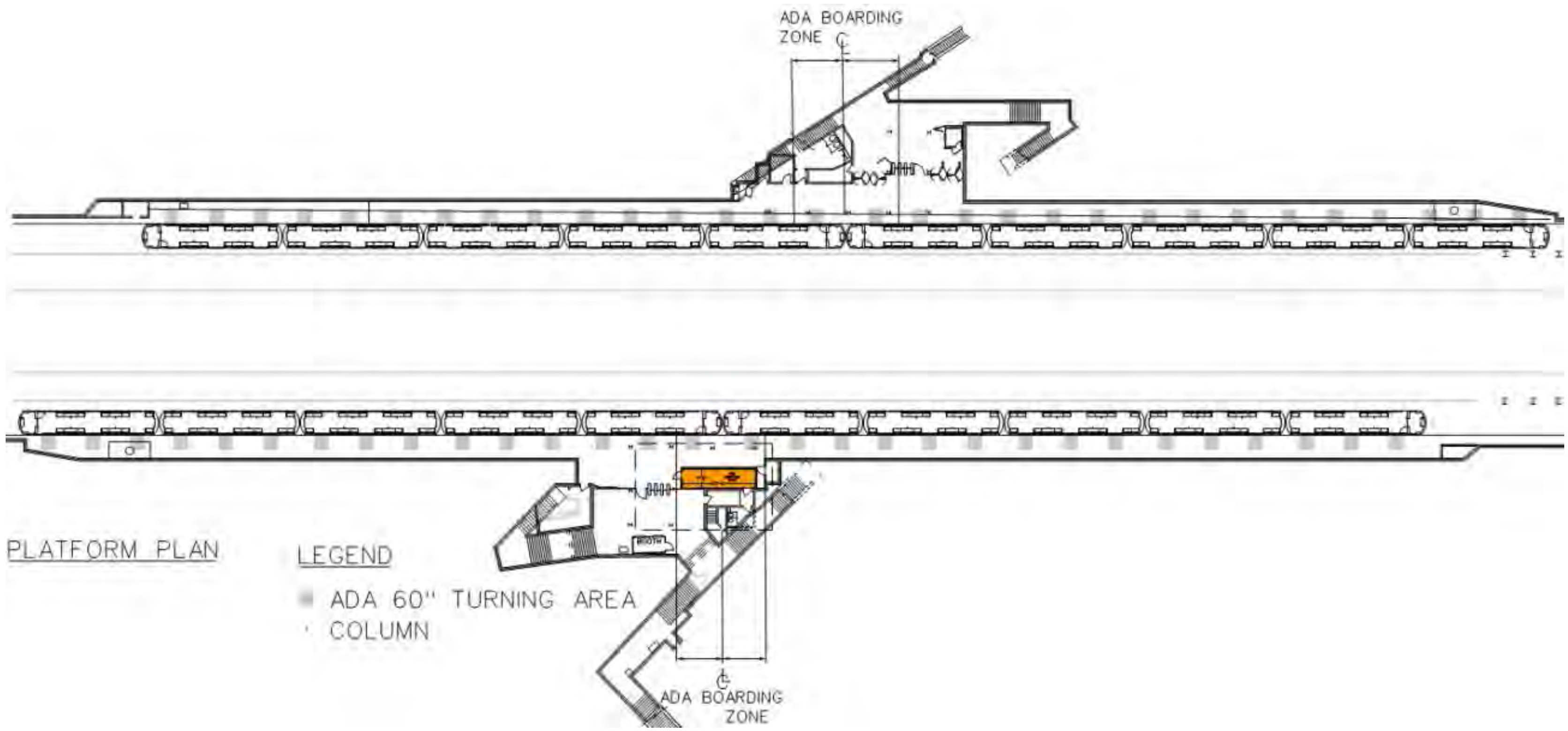

***Figure 1** – Overall Station Plan*
Bergen Street Station

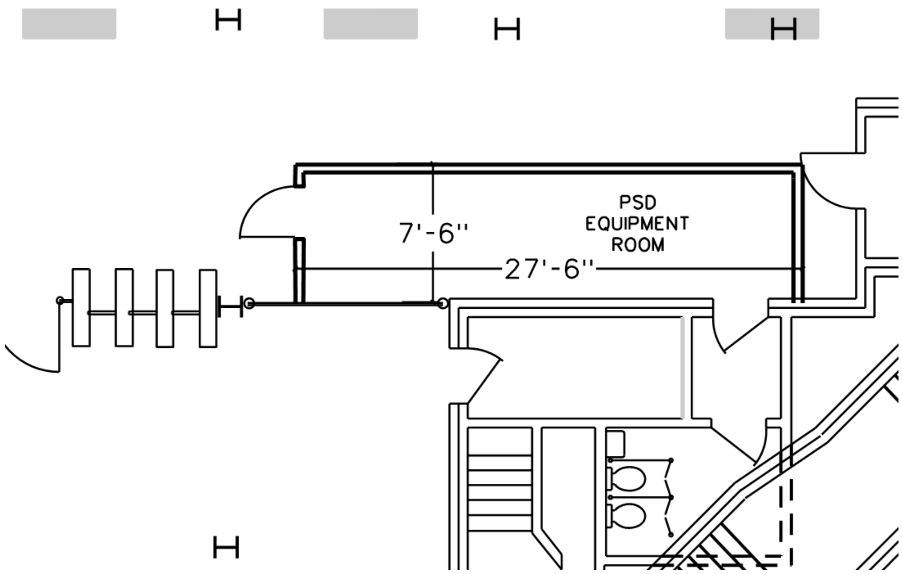

Figure 2 *– PSD Equipment Room 1 Detail*
Bergen Street Station

Figure 3 *– Typical platform view*
Bergen Street Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. An analysis of electrical reserve service could not be performed due to inaccessibility during survey. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1, please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (normal service)

Station Name	Bergen Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	40.8
Apparent Power (kVA)	51.0
Station Peak Demand Load, Max Current, (A)	141.7
Maximum Amount of Doors	40.0
PSD Total Load Including All Miscellaneous Loads, (A)	121.6
Total Load (Station Peak + PSD), (A)	263
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	537
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram and observations of breaker schedule, showing 800A fuses at Service switch. The analysis is based on available Normal meter reading

***Table 1**. Normal Service Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $26.9M to install APGs and $33.2M to install PSDs (See Appendix E)

1.16 – MR 340 | Grand Army Street Station

Summary: *Grand Army Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 29" (see figure 1).*

Description

The Grand Army Street Station is a below-grade station with one straight center/island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 32'-4" throughout. The corridor width at this station's western end is 44". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 29" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
Grand Army Plaza Station

1.17 – MR 341 | Eastern Parkway Brooklyn Street Station

Summary: *Eastern Parkway Brooklyn Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the northbound platform as the existing width is 5'-6" (see figure 1).*

Description

Eastern Parkway Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-6' to 11'-10".

Platform width at the ends of the platforms is 5'-6" or 66". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

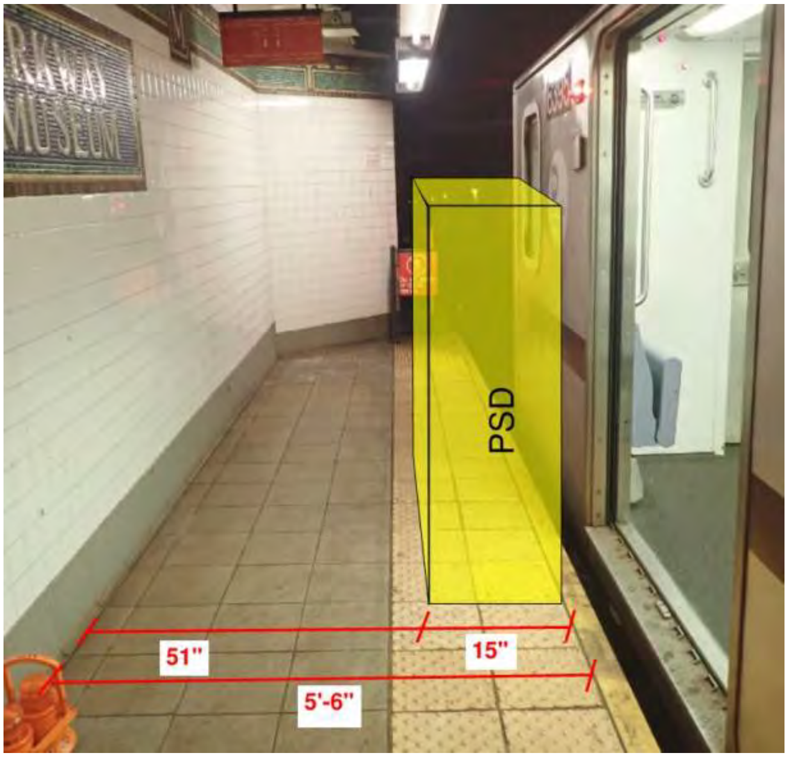

***Figure 1** – Non-Compliant egress condition*
Eastern Parkway Station

1.18 – MR 342 | Franklin Avenue Station

***Summary:** Franklin Avenue Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Franklin Avenue Station is a below-grade station consisting of two center / island platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

***Figure 1 –** Column 16" from the edge*
Franklin Avenue Station

1.19 – MR 343 | Nostrand Avenue / Eastern Pkwy

Summary: *Nostrand Avenue Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

Nostrand Avenue Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. Platform widths vary from 7'-10" to 11'-10". There is a single row of columns on each platform.

Due to the limited width of the existing platforms, there is no available space for the equipment room. Figure 2 below shows the minimum width required (12'-11") for construction of a PSD equipment room on a station platform. Figure 1, below, demonstrates the lack of available space within the main control area.

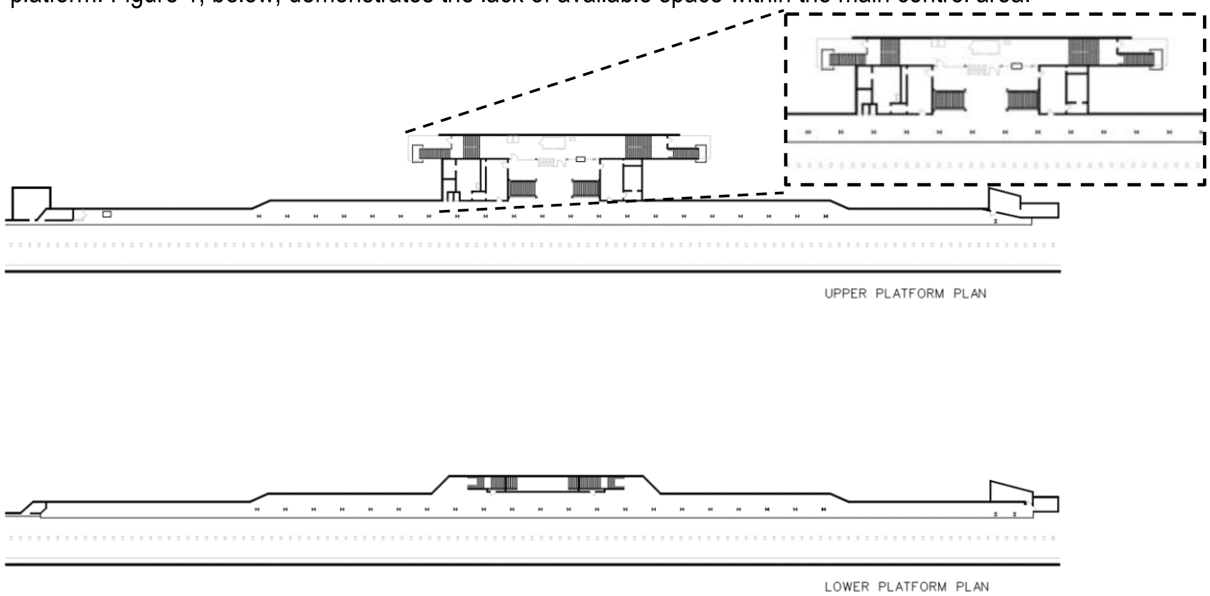

***Figure 1** – Congested/Narrow Station Plan*
Nostrand Avenue Eastern Pkwy

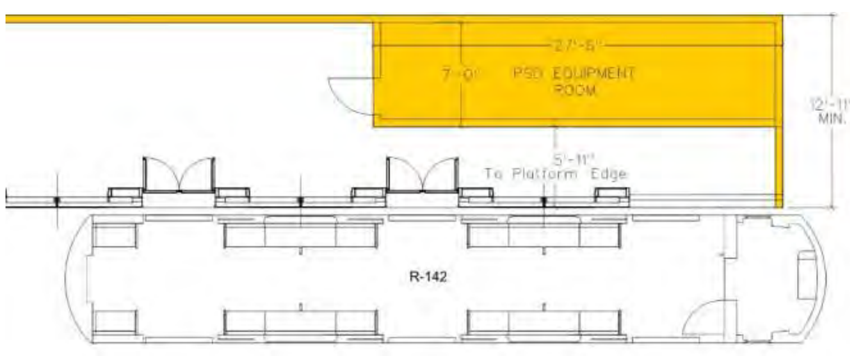

***Figure 2 –** Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimension

1.20 – MR 344 | Kingston Avenue

Summary: *Kingston Avenue Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

Kingston Avenue Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. Platform widths vary from 7'-10" to 11'-10". There is a single row of columns on each platform.

Due to the limited width of the existing platforms, there is no available space for the equipment room. Figure 2 below shows the minimum width required (12'-11") for construction of a PSD equipment room on a station platform. Figure 1, below, demonstrates the lack of available space within the main control area.

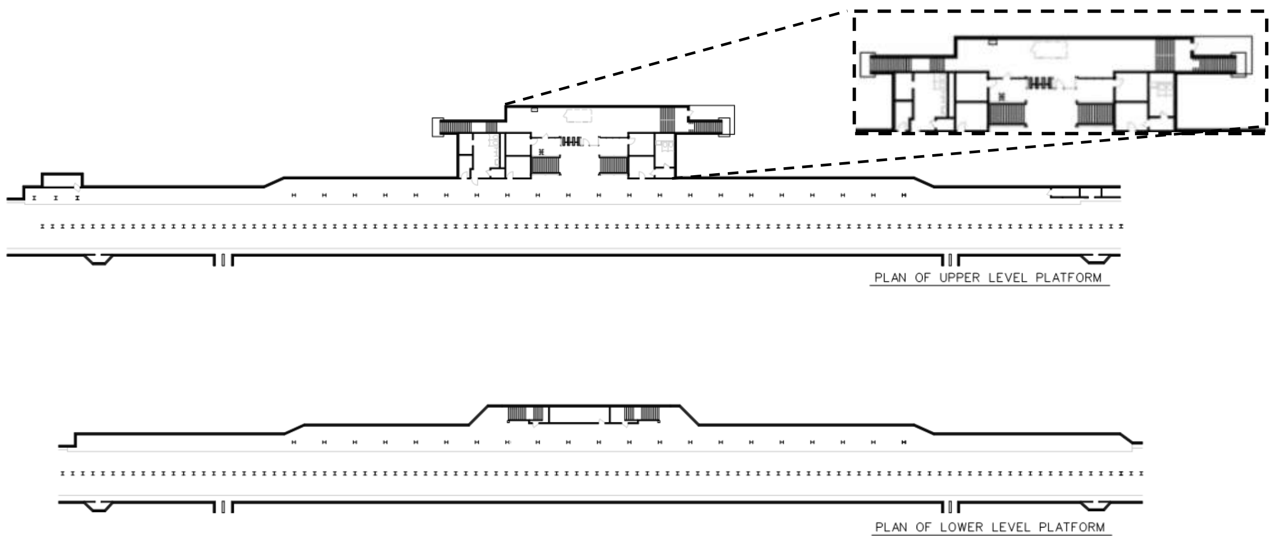

Figure 1 *– Congested/Narrow Station Plan*
Kingston Avenue

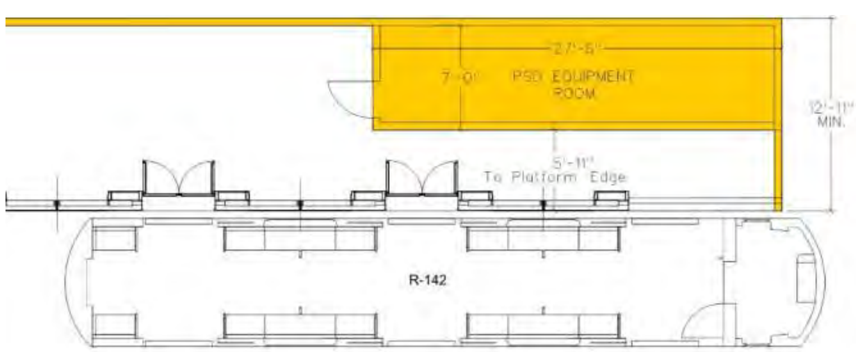

Figure 2 – *Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimension

1.21 – MR 345 | Crown Heights / Utica Avenue

Summary: *Crown Heights Station is not feasible for both APGs and PSDs as the columns which are located 12" from the platform edge would impede installation, access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Crown Heights Station is a below-grade station consisting of two center / island platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platform which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 12" from the platform edge. This dimension does not allow for installation and maintenance of the 15"-wide APG/PSD system. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 12" from the edge*
Crown Heights Utica Avenue

1.22 – MR 346 | Sutter Avenue

Summary: *Sutter Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Sutter Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 8'-10" to 9'-10". The platforms are straight with one row of columns inset in the windscreen. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Sutter Avenue Station

Figure 2 *– Precast Slab*
Sutter Avenue Station

1.23 – MR 347 | Saratoga Avenue / Livonia Avenue

Summary: *Saratoga Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Saratoga Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 9'-10" throughout. The platforms are straight with one row of columns inset in the windscreen. See figure 1 & 2 for reference.

***Figure 1** – General Station Condition*
Saratoga Avenue Station

***Figure 2** – Precast Slab*
Saratoga Avenue Station

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1.24 – MR 348 | Rockaway Avenue

Summary: *Rockaway Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Rockaway Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 9'-8" throughout. The platforms are straight with one row of columns inset in the windscreen. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Rockaway Avenue Station

Figure 2 *– Precast Slab*
Rockaway Avenue Station

1.25 – MR 349 | Junius Street

Summary: *Junius Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Junius Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 9'-10" throughout. The platforms are straight with one row of columns inset in the windscreen. See figure 1 & 2 for reference.

***Figure 1** – General Station Condition*
Junius Street Station

***Figure 2** – Precast Slab*
Junius Street Station

1.26 – MR 350 | Pennsylvania Avenue

Summary: *Pennsylvania Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Pennsylvania Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 9'-10" throughout. The platforms are straight with one row of columns inset in the windscreen. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Pennsylvania Avenue Station

Figure 2 *– Precast Slab*
Pennsylvania Avenue Station

1.27 – MR 351 | Van Siclen Avenue Station

Summary: *Van Siclen Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Van Siclen Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 9'-10" throughout. The platforms are straight with one row of columns inset in the windscreen. See figure 1 & 2 for reference..

Figure 1 *– General Station Condition*
Van Siclen Avenue Station

Figure 2 *– Precast Slab*
Van Siclen Avenue Station

1.28 – MR 352 | New Lots Avenue Station

Summary: *New Lots Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The New Lots Avenue Station is an elevated station with one center / island platform. The platform structure is precast concrete. The width of the platforms is approximately 15'-0" throughout. The platform is straight with one row of columns supporting the station canopy. See figure 1 for reference.

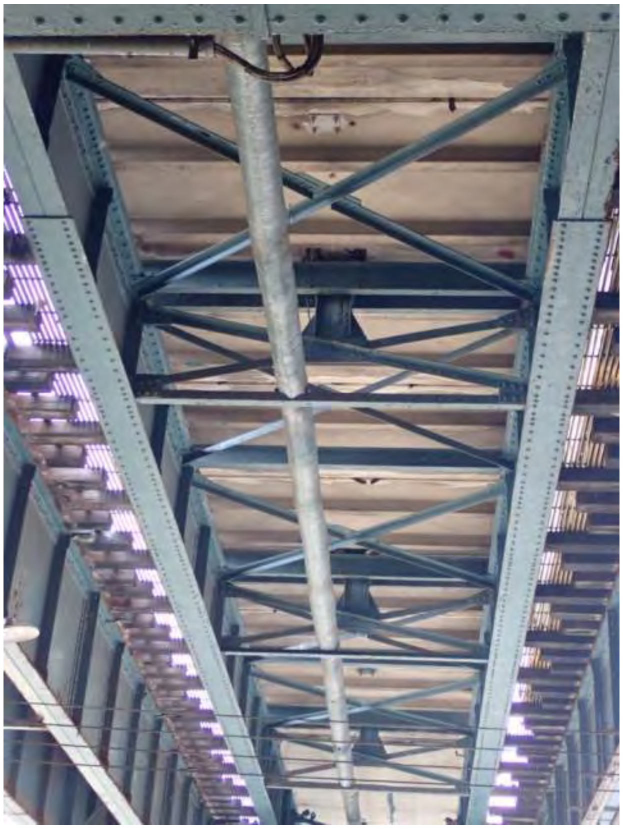

***Figure 1** – Precast Slab*
New Lots Avenue Station

1.29 – MR 436 | 148th Street Station

Summary: *148th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met at the south end of the platform as the remaining width would be 23" (see figure 1).*

Description

The 148th Street Station is an at-grade station with one straight center / island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 19'-4". The corridor width at the dispatcher's office is 38". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 23" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
148th Street Station

1.30 – MR 437 | 145th Street Station

Summary: *145th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the northbound platform as the existing width is 4'-0"" (see figure 1).*

Description

145th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 4'-0' to 12'-10".

Platform width at the southern end of both platforms is 4'-0" or 48". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

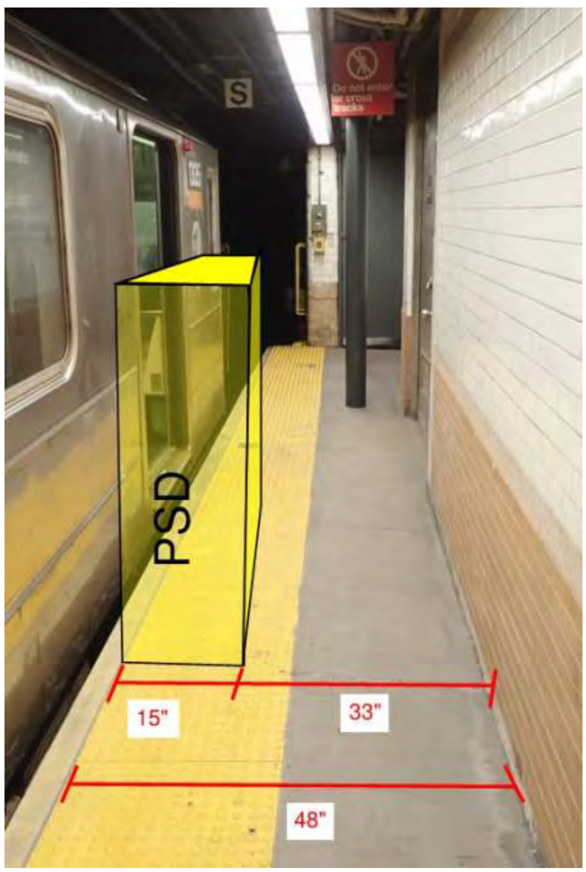

***Figure 1** – Non-compliant ADA condition*
145th Street Station

1.31 – MR 438 | 135th Street

Summary: *135th Street Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

135th Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

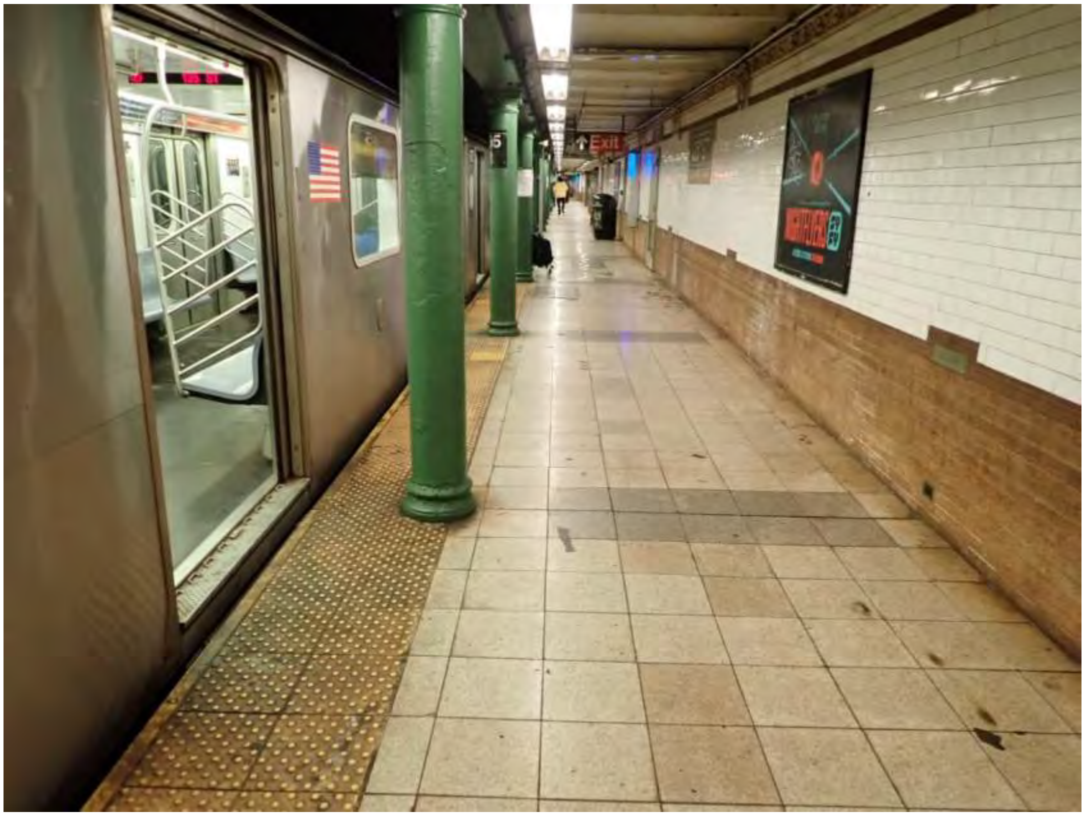

Figure 1 – *Column 16" from the edge*
135th Street Station

1.32 – MR 439 | 125th Street

Summary: *125th Street Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede installation, access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

125th Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

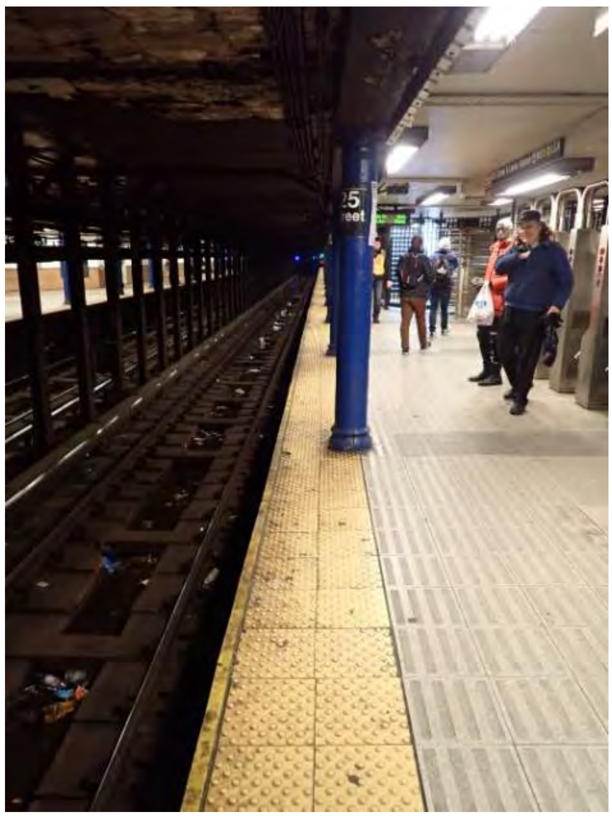

***Figure 1 –** Column 16" from the edge*
125th Street Station

1.33 – MR 440 | 116th Street Station

Summary: *116th Street Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede installation, access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

116th Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 16" from the edge*
116th Street Station

1.34 – MR 441 | 110th Street Station

Summary: *110th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the northbound platform as the existing width is 5'-0" (see figure 1).*

Description

110th Street Station is a below-grade station with one center / island platform. The platform structure is cast-in-place concrete. The width of the platform varies from 5'-0'" to 20'-0".

The corridor width at the center of this platform adjacent to the control area is constrained to o 5'-0" or 60". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

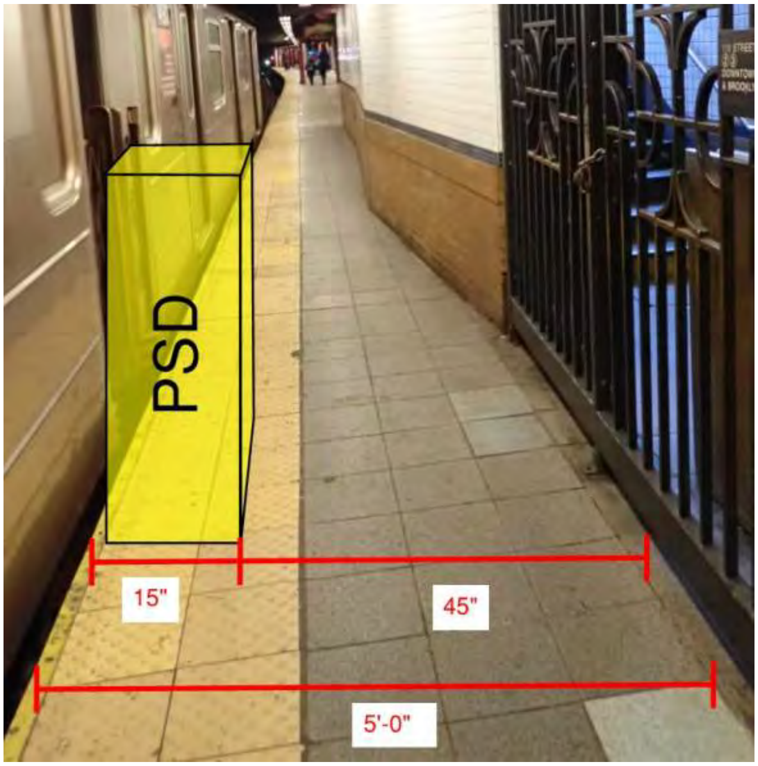

***Figure 1** – Non-Compliant egress condition*
110th Street Station

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*
>
> a. *Column location in relation to the platform edge*
> b. *Platform edge clearance adjacent to stairs and other impediments*
> c. *Impacts to ADA path of travel and boarding areas*
> d. *Conflicts of PSD/APG/RPSDs with Signals cables*
> e. *Sufficient platform width*
> f. *Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*
>
> a. *Structural capacity of platforms to accept PSD/APG/RPSDs*
> b. *Feasibility & location for PSD/APG/RPSDs equipment room*
> c. *Confirmation of adequate power for PSD/APG/RPSDs*
> d. *Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> e. *Determination of communications requirements, availability and cost*
> f. *Determination of gap detection and entrapment avoidance technology requirements*
> g. *Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
   - Double the amount of motors as PSDs (each motor operating a single leaf).
   - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
   - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
   - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

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If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	**Dedicated Loop**	**Wayside Only**
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

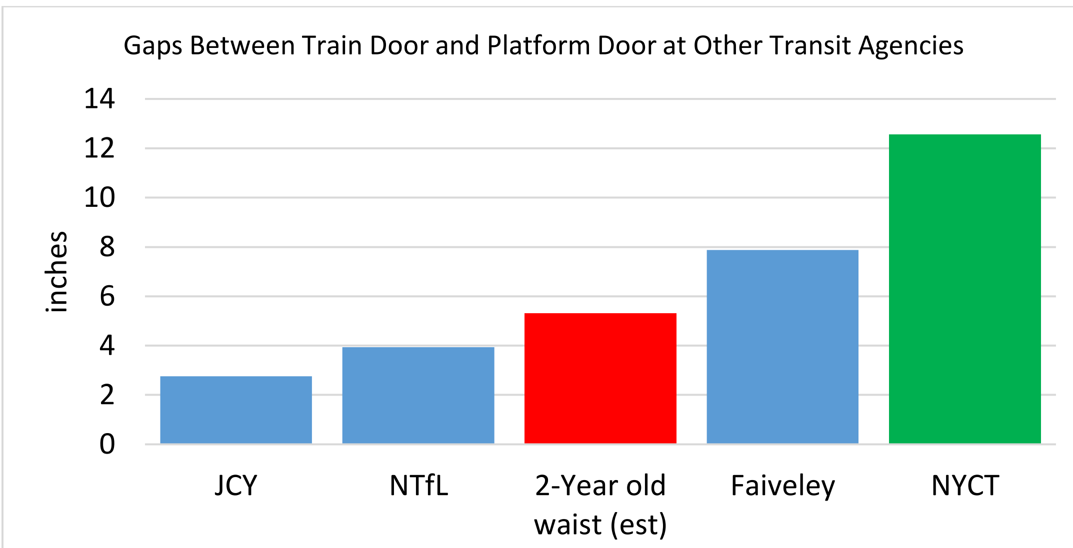


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

 *Figure 3 - Paris: no entrapment detection*	 *Figure 4 - Paris: no entrapment detection*	 *Figure 5 - France ATO: no entrapment detection*
 *Figure 6 - Paris, on curve: used 3 2D scanning lasers per door*	 *Figure 7 - Shanghai: End of platform light detection*	 *Figure 8 - Seoul: Platform observers*

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

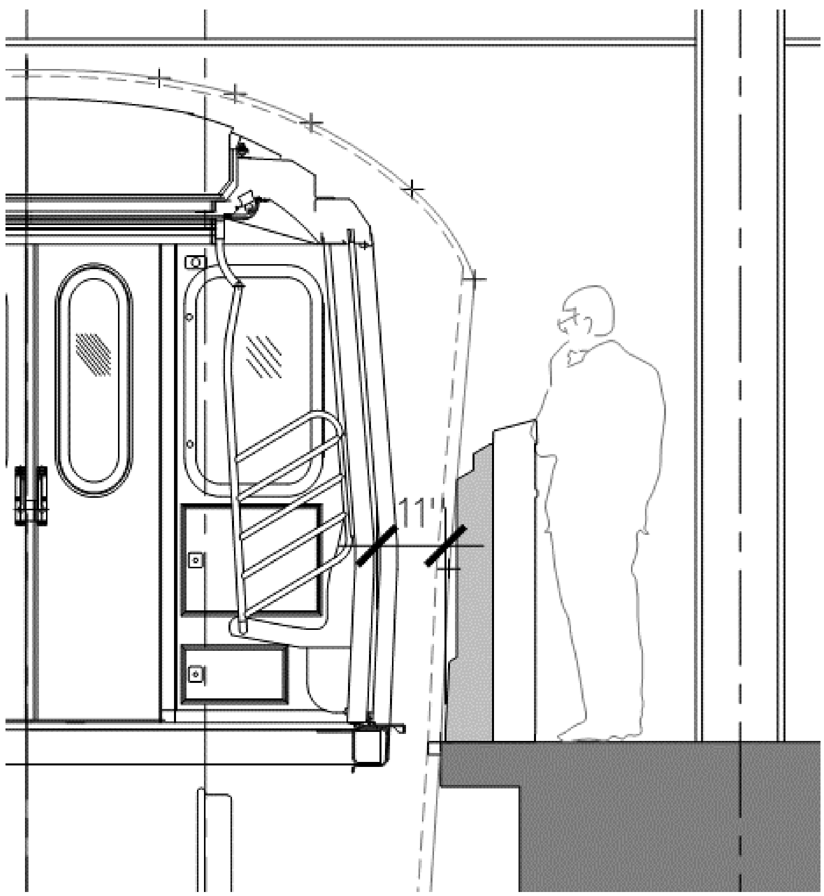


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber “bumpers” on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6” into the line equipment envelope. This would leave a 5” gap between the platform and car doors allowing approximately 2” of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5” by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor’s window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor’s window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **<u>bold/underline</u>**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	**PSD System 1**	**PSD System 2**	**PSD System 3**
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are "existing" as defined by code. All the rolling stock is also to be considered "existing" under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60" radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36" of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

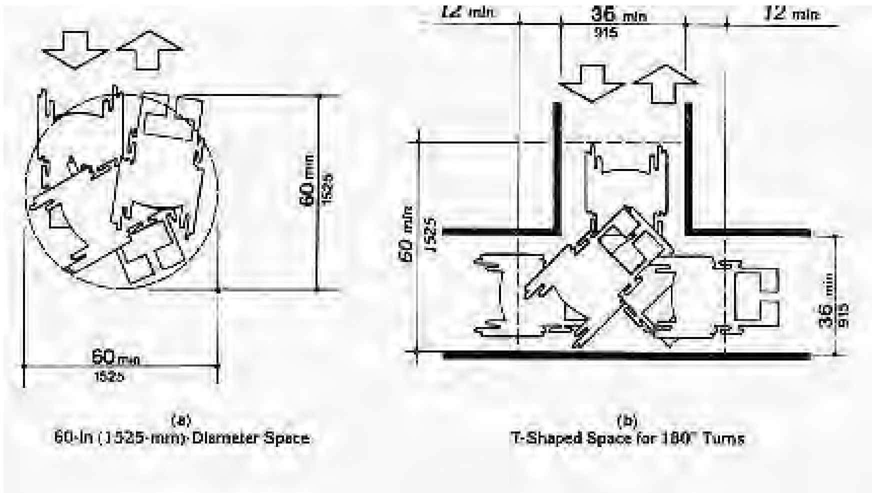
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

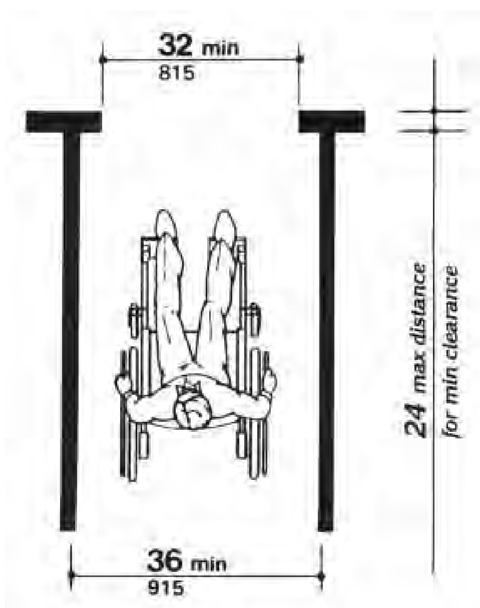


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

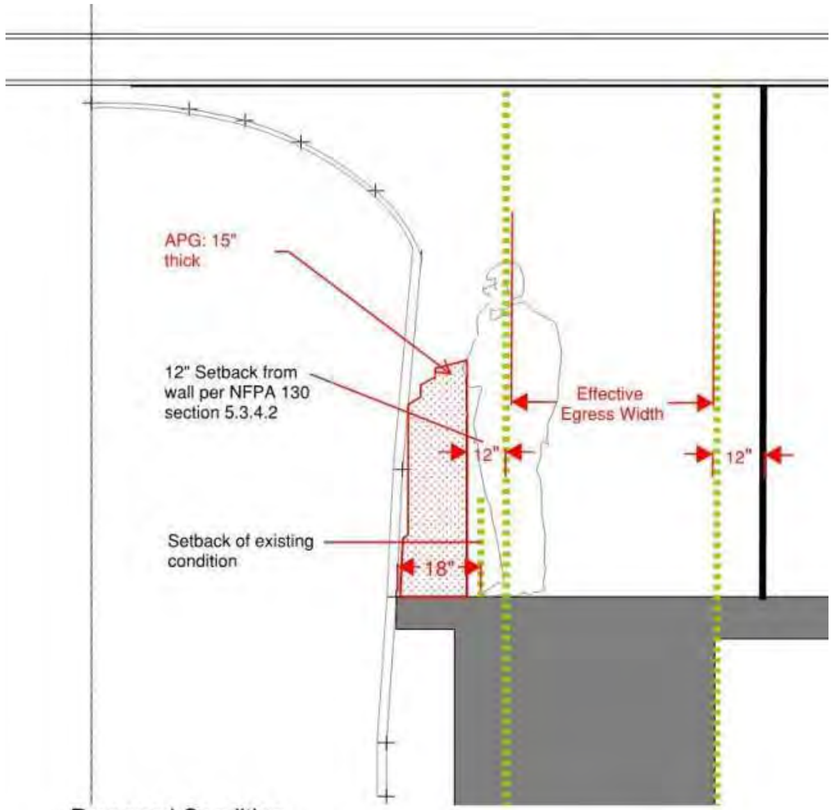
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15” of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

Table of Contents

Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

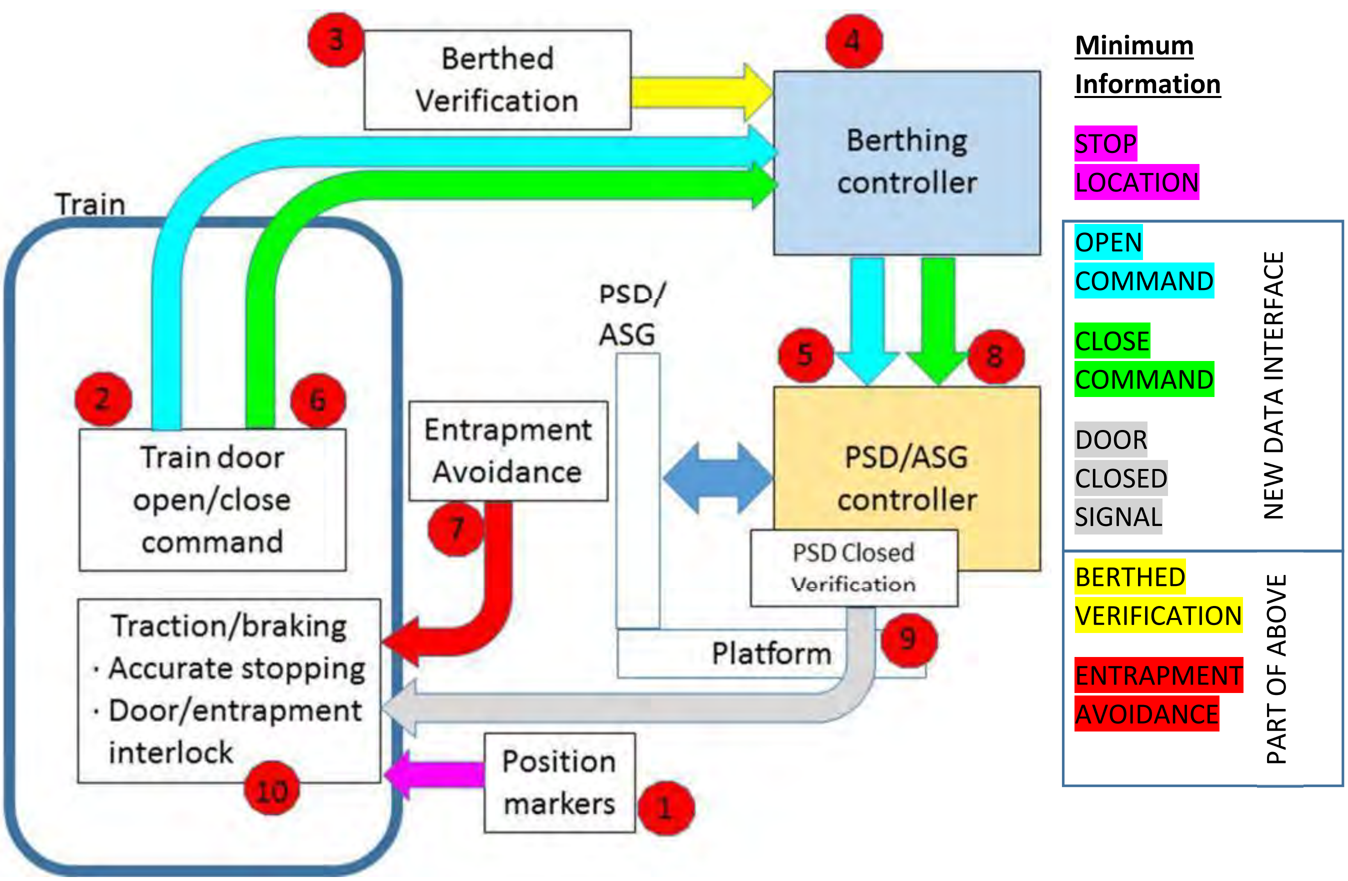
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

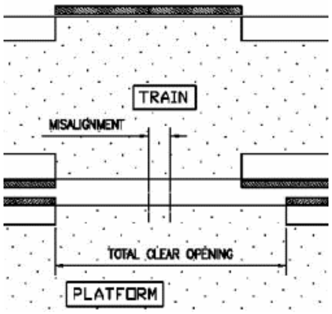
C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5" clear opening, a design for NY should meet the ADA Accessibility Guideline of 36".

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a 'distance totem' which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy's COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command, Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically

If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.

For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4'-0"). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

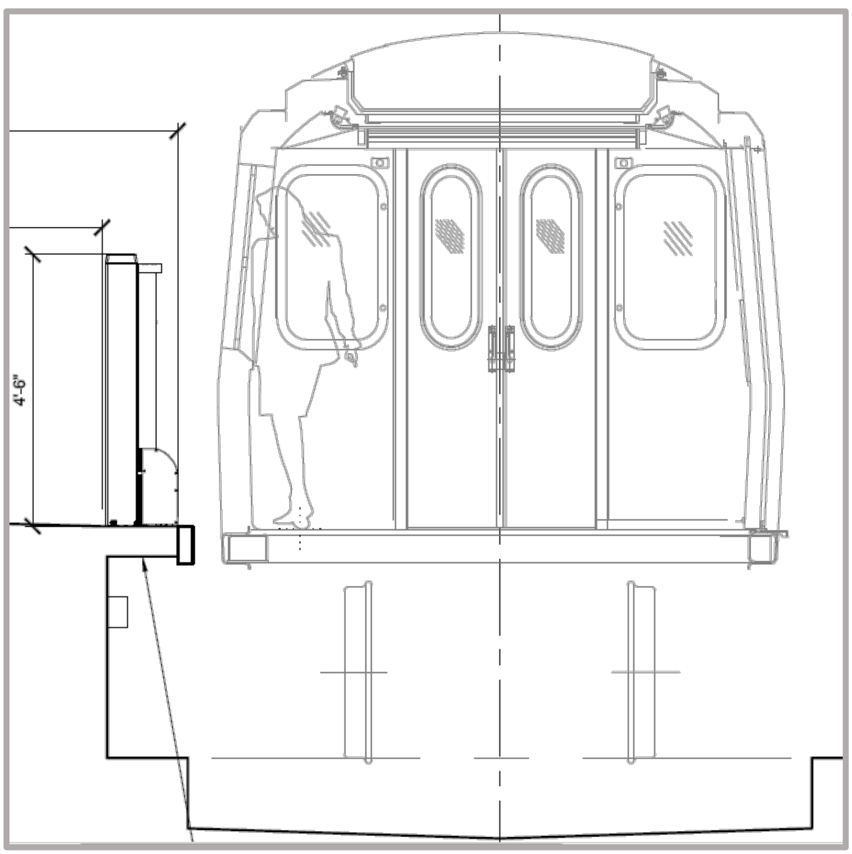


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

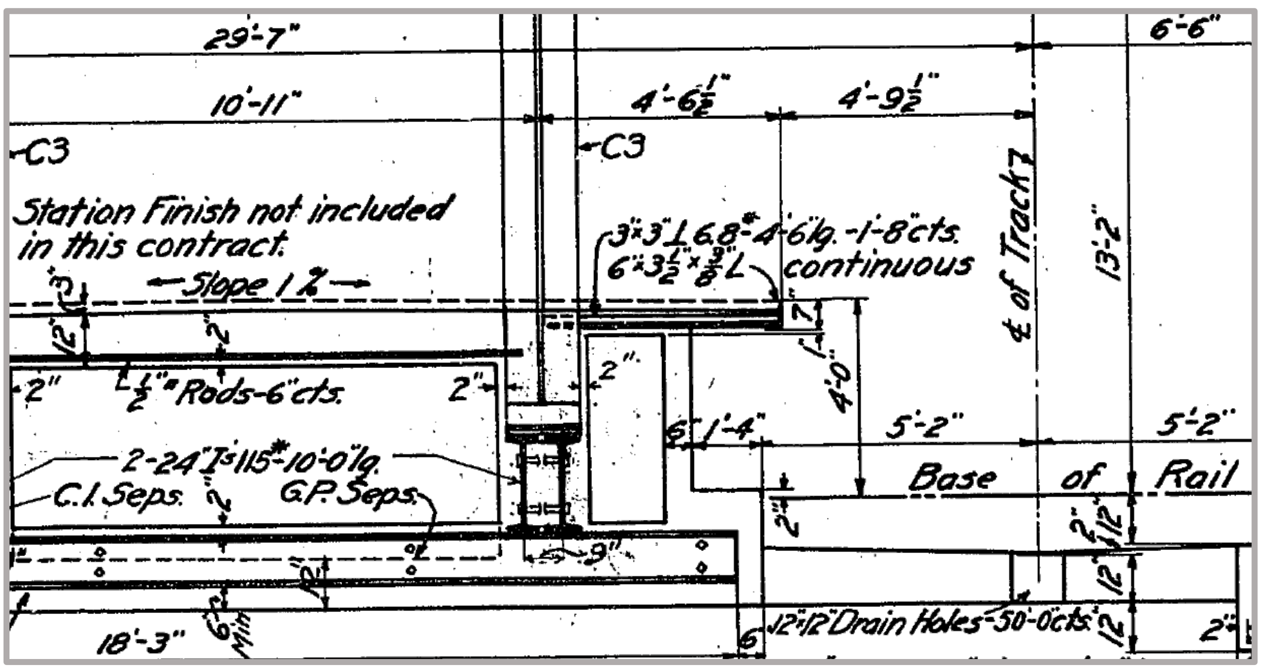


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

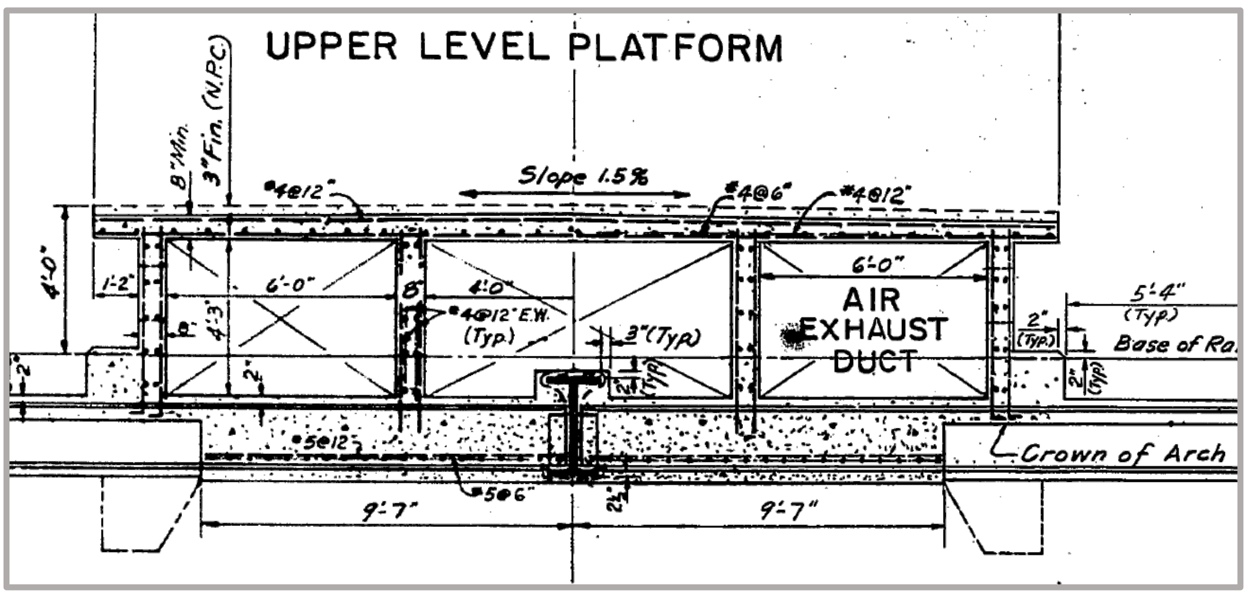


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

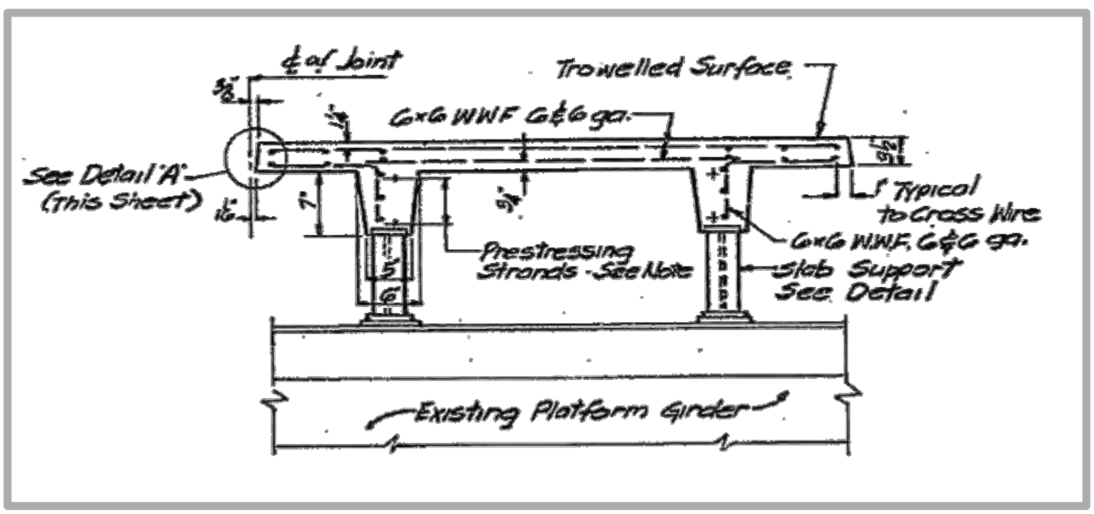


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

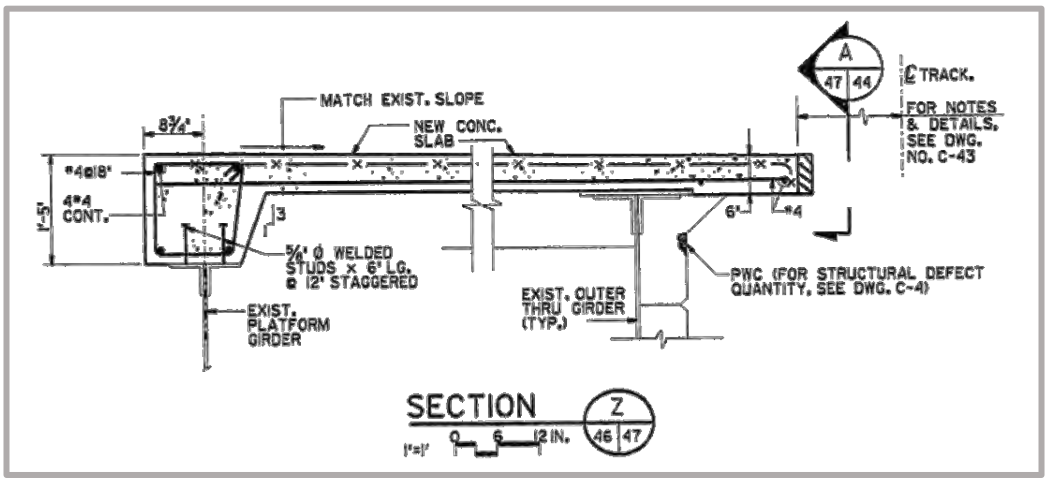


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2'-9"), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

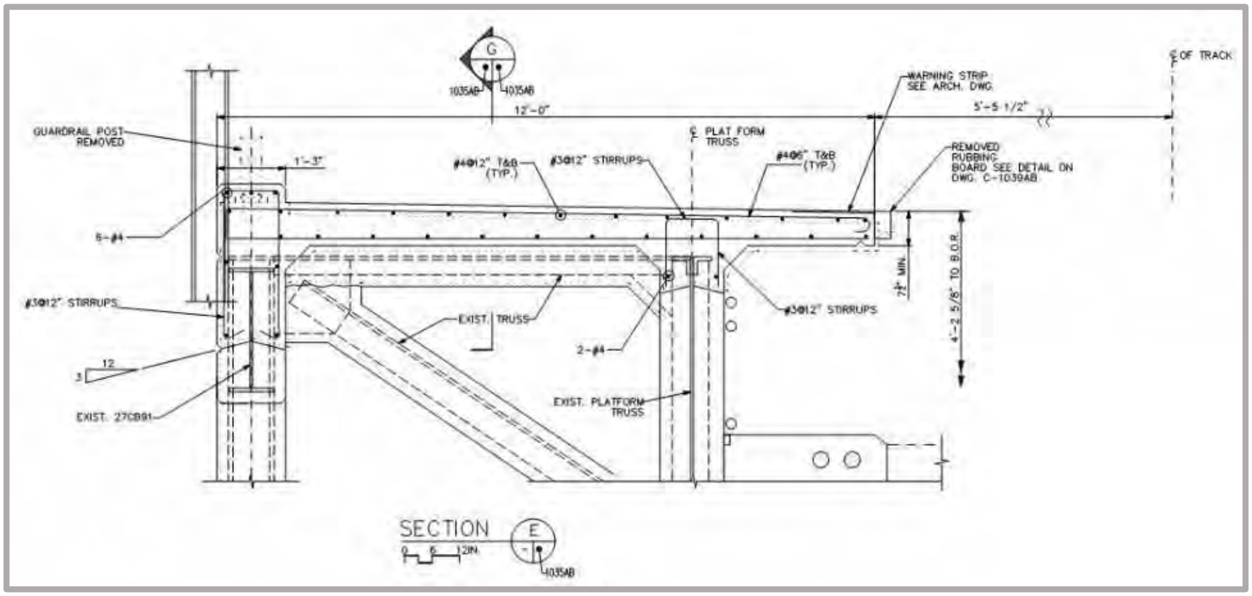


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3" thick structural slab with an approximately 3" thick topping slab. If the topping slab is fully removed, a 6" thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6" thick slab will be sufficient for a cantilever length of up to approximately 3'-0", greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6" structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6" minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

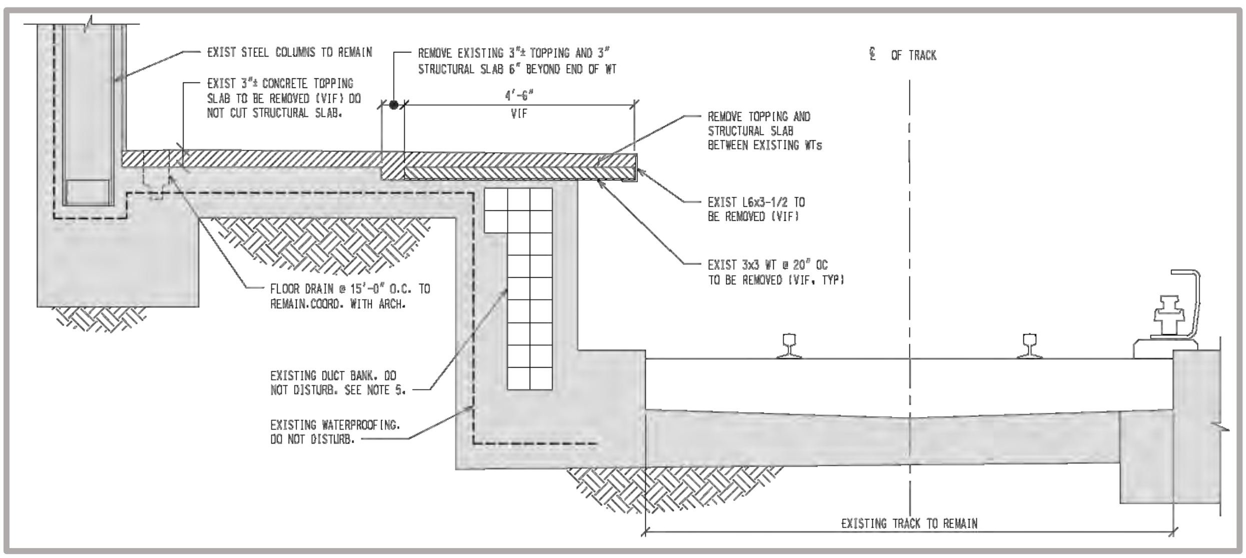


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

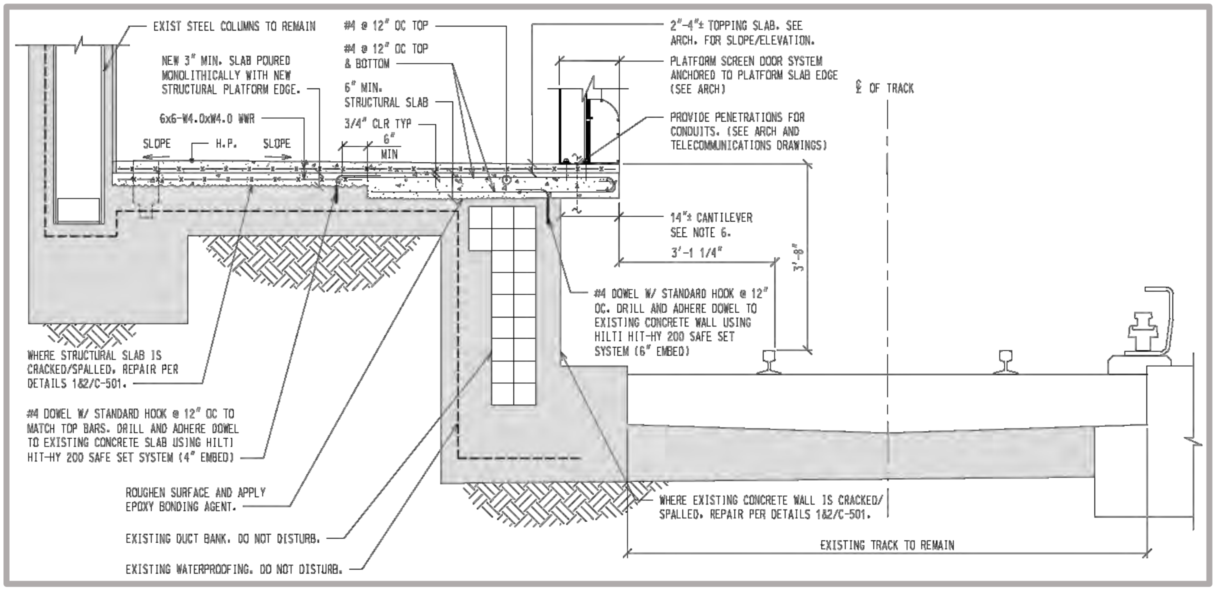


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

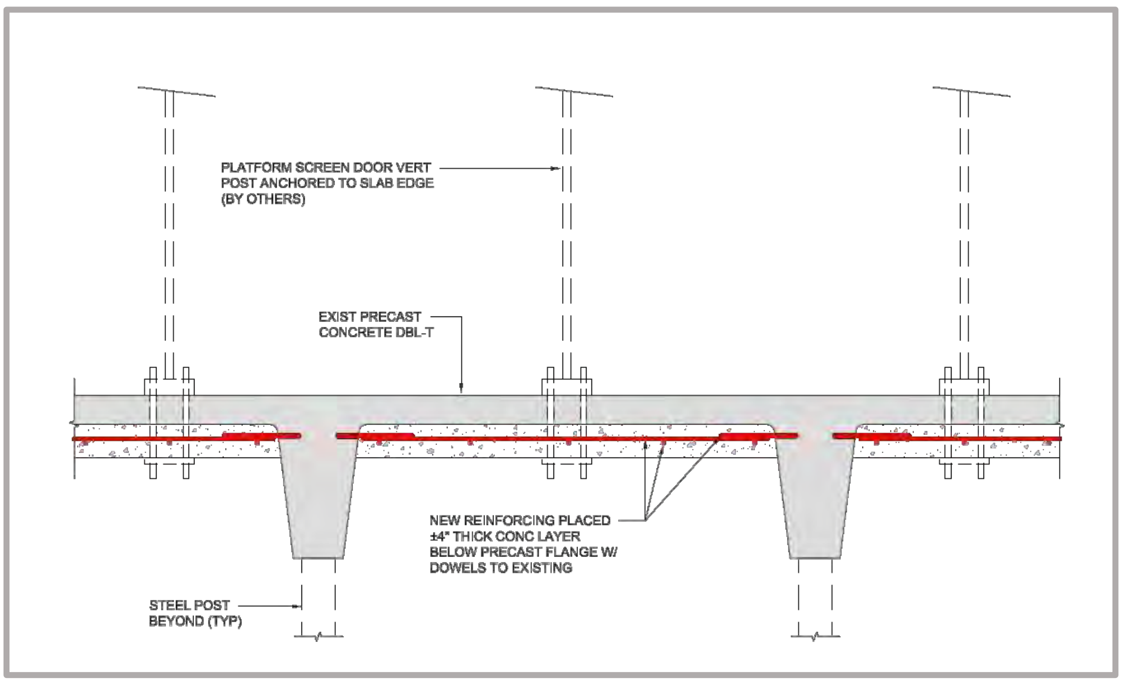


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

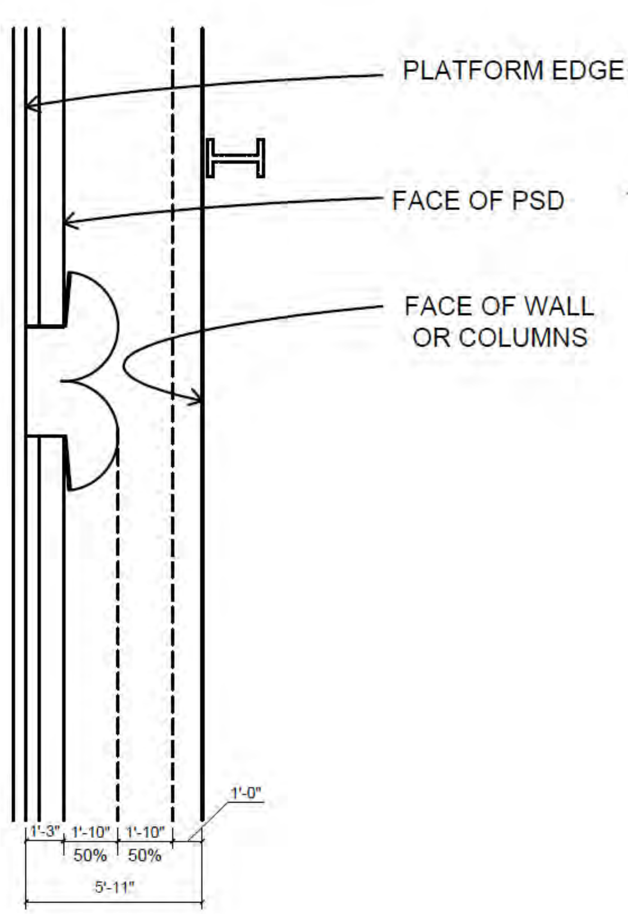
The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5' – 11" of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis



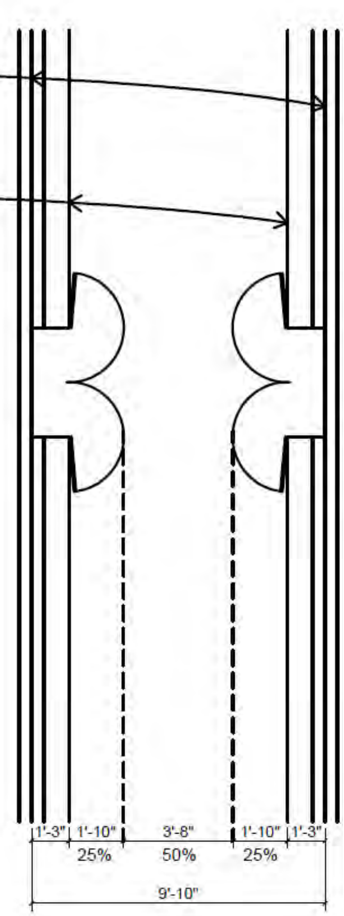


FIGURE 1: SIDE PLATFORM

FIGURE 2: CENTER PLATFORM

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	9	$ 63,500 per month [Year 01]	$ 571,500		
		12	$ 83,590 per month [Year 02]	$ 1,003,080		
		12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment.	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
		12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663

	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663

7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *	
		Year 3	$ 257 per hour *	
	Optional :	Year 4	$ 268 per hour *	
	Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

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ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-3 Line Stations
ESTIMATE DATE:	February 20, 2019

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-3 Line Stations

MTA/NYCT

February 20, 2019

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.2 *APGs / PSDs will provide 29 emergency egress doors with push bars per platform*
1.3 *Each platform edge will have 40 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 It is assumed that each train has 10 cars on this line
2.2 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.3 In respect of the PSD option, only platforms that have not been upgraded in the recent past will require platform edge replacement.
2.4 There are no special security requirements made necessary by installation of the APG system
2.5 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.6 This estimate does not provide for the replacement of Platform Edge Lighting
2.7 Premium cost for night time work is considered 50% of total labor cost

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ORDER OF MAGNITUDE COSTS

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train- 3 Line Stations

MTA/NYCT

February 20, 2019

BASIS OF ESTIMATE

3.0 ***Exclusions - Costs not included in the estimate:***

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems
3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length
3.4 Costs associated with NYCT State Of Good Repair improvements to the station
3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.
3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs
3.7 Escalation Cost is not included; Anticipate at 5% per annum.
3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.
3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium
3.10 NYCT project cost is not included
3.11 GO and flagging cost is not included
3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or "soft" costs:***

4.1 Design and Construction Contingency
4.2 Contractor O & P
4.3 Insurance
4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 Given the limited time available, no drawings were developed to support this estimate.

MTA /NYCT
Tier 2 -3 Report on Feasibility of Platform Edge Barriers
for Train-3 Line Stations
February 20, 2019

ORDER OF MAGNITUDE COSTS			MRN 339
	DESCRIPTION		BERGEN STREET
1	AUTOMATIC PLATFORM GATES (APG'S)		$14,242,796
2	ADA ZONE		ADA COMPLIANT
3	ENVIRONMENTAL		Excl.
	TOTAL DIRECT COST		$14,242,796
4	GENERAL REQUIREMENTS	15.00%	$2,136,419
	SUB-TOTAL:		$16,379,215
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,094,804
	SUB-TOTAL:		$20,474,019
6	OVERHEAD & PROFIT	15.00%	$3,071,103
	SUB-TOTAL:		$23,545,122
7	BONDS & INSURANCE	3.75%	$882,942
	SUB-TOTAL:		$24,428,064
	SUBTOTAL CONSTRUCTION COST W/O ACM		**$24,428,064**
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.
9	ACM ABATEMENT		BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		**$24,428,064**
10	DESIGN CONSULTANT FEES	10.00%	$2,442,806
11	STATURORY ADA IMPROVEMENTS		Excl.
	TOTAL PROJECT COST (APG OPTION)		**$26,870,870**
	ADD ALTERNATIVES		
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		3,383,096
	Add for Markups (as above)	88.66%	2,999,551
	SUB-TOTAL PSD ALTERNATIVE		**$6,382,646**
	TOTAL PROJECT COST (PSD OPTION)		**$33,253,516**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-3 Line Stations

20-Feb-19

STATION : BERGEN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	512	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	512	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,024**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,024	LF	7	7,168
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,120	SF	12	61,440
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	103	CY	2,500	257,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,026	EA	25	25,650
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,026	EA	25	25,650
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,024	LF	95	97,280
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,024	LF	15	15,360
26	Remove existing platform tiles	1,024	LF	12	12,288
27	Sawcut existing topping concrete at perimeter of removal area	1,024	LF	5	5,120
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,144	SF	8	49,152
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-0" wide strip	560	SF	8	4,480
30	New Work				
31	New concrete topping to match existing	1,024	SF	15	15,360

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STATION : BERGEN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	560	SF	15	8,400
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,133	SF	750	1,599,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	192,045	192,045
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-3 Line Stations

20-Feb-19

STATION : BERGEN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,024	LF	60	61,440
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	200	LF	60	12,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-3 Line Stations

20-Feb-19

STATION : BERGEN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,286,799	3,286,799
112					
113	TOTAL PSD WORK:				$ 14,242,796
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,526	SF	750	3,394,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	353,777	353,777
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	68,200
129	L6x6x1/2 continuous angle	8	TONS	17,500	131,891
130	Drilling and bolting - 4 bolts at each connection	410	EA	216	88,474
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-3 Line Stations

20-Feb-19

STATION : BERGEN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	**OMIT**				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,133)	SF	750	(1,599,750)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	192,045	(192,045)
152	Platform Edge Reconstruction work	(1)	LS	485,440	(485,440)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,024)	LF	30	(30,720)
155					
156	Allow loss of production to work at night say 50%	1	LS	780,714	780,714
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				**$ 3,383,096**

New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR '4' SERVICE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

FINAL SUBMITTAL DATE: March 29, 2019

STV 100 Years

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Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. Our Tier 1 analysis found no instances of door misalignment between car classes for this line. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 54 newly evaluated stations, 49 have been found to be not suitable for the installation of PSDs.

[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to half-height barriers]

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues: the platform edge barriers are 15" wide. Where an existing object (wall, stair, and railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Under the following conditions, PSDs are declared infeasible:
  - Limit the ability of a wheelchair to turn within a 5'-0" circle
  - Limit path of travel to less than a 32" pinch width (defined as an obstruction that measures less than 2'-0" longitudinally, i.e. columns)
  - Limit path of travel to be less than a 36" corridor as defined by the edge of a staircase, railing or room
- Insufficient space for the PSD equipment room: the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow: due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements regarding the placement of these new barriers in an existing station environment.
- Structural considerations: existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.

- Columns at platform edge: at certain stations, the columns are positioned 16" to 24" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space.

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the previously proposed 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the PSD barriers and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is used for refuse removal at most of the 4-line stations. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the (off) loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in damage from these carts along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 9% of the '4' Line stations. Total implementation cost would be $136.6M for APGs and $170.6M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; that estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of $931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 5 feasible stations, the aggregate annual maintenance cost would be $4.6M.

Summary Table

(9% Feasible 5/54)

MR No.	Station Names	Station Type	Platform Type	Feasibility	Issues/Reason for Failure	Cost APGs	Cost PSDs
337	Nevins Street Flatbush	SUB	Island	No	Columns too close to edge	-	-
338	Atlantic Avenue Barclay	SUB	Island	No	Columns too close to edge	-	-
339	Bergen Street	SUB	Side	Yes	-	$26.9M	$33.3M
340	Grand Army Plaza	SUB	Island	No	ADA Clearance	-	-
341	Eastern Parkway	SUB	Side	No	Non-Compliant Egress Path	-	-
342	Franklin Avenue	SUB	Island	No	Columns too close to edge	-	-
343	Nostrand Avenue	SUB	Side	No	No PSD Room Location	-	-
344	Kingston Avenue	SUB	Side	No	No PSD Room Location	-	-
345	Crown Heights Utica	SUB	Island	No	Columns too close to edge	-	-
346	Sutter Ave. Rutland Rd	ELV	Side	No	Precast Platform	-	-
347	Saratoga Avenue	ELV	Side	No	Precast Platform	-	-
348	Rockaway Avenue	ELV	Side	No	Precast Platform	-	-
349	Junius Street	ELV	Side	No	Precast Platform	-	-
350	Pennsylvania Avenue	ELV	Side	No	Precast Platform	-	-
351	Van Siclen Avenue	ELV	Side	No	Precast Platform	-	-
352	New Lots Avenue	ELV	Side	No	Precast Platform	-	-
378	Woodlawn	ELV	Island	No	Precast Platform	-	-
379	Mosholu Parkway	ELV	Side	No	Precast Platform	-	-
380	Bedford Park Blvd.	ELV	Side	No	Precast Platform	-	-
381	Kingsbridge Road	ELV	Side	No	Precast Platform	-	-
382	Fordham Road	ELV	Side	No	Precast Platform	-	-
383	183rd Street	ELV	Side	No	Precast Platform	-	-
384	Burnside Avenue	ELV	Island	No	Precast Platform	-	-
385	176th Street	ELV	Side	No	Precast Platform	-	-
386	Mt. Eden Avenue	ELV	Side	No	Precast Platform	-	-
387	170th Street	ELV	Side	No	Precast Platform	-	-
388	167th Street	ELV	Side	No	Precast Platform	-	-
389	161st Street Yankee	ELV	Side	No	Precast Platform	-	-
390	149th Street	SUB	Island	No	Non-Compliant Egress Path	-	-
391	138th Street	SUB	Side	No	ADA Clearance	-	-
392	125th Street	SUB	Island	No	ADA Clearance	-	-
393	116th Street	SUB	Side	No	No PSD Room Location	-	-
394	110th Street	SUB	Side	No	No PSD Room Location	-	-
395	103rd Street	SUB	Side	Yes	-	$27.6M	$34.5M
396	96th Street	SUB	Side	No	Non-Compliant Egress Path	-	-
397	86th Street	SUB	Side	No	ADA Clearance	-	-
398	77th Street	SUB	Side	No	ADA Clearance	-	-
399	68th Street Hunter	SUB	Side	No	Non-Compliant Egress Path	-	-
400	59th Street	SUB	Side	No	ADA Clearance	-	-
401	51st Street	SUB	Side	Yes	-	$27.3M	$34.4M
402	Grand Ctrl 42nd St	SUB	Island	No	ADA Clearance	-	-
403	33rd Street	SUB	Side	No	Columns too close to edge	-	-

404	28th Street	SUB	Side	No	Columns too close to edge	-	-
405	23rd Street	SUB	Side	No	Columns too close to edge	-	-
406	14th Street Union	SUB	Island	No	Gap Fillers	-	-
407	Astor Place	SUB	Side	No	ADA Clearance	-	-
408	Bleeker St.	SUB	Side	No	Columns too close to edge	-	-
409	Spring St.	SUB	Side	No	Columns too close to edge	-	-
410	Canal Street	SUB	Side	No	Columns too close to edge	-	-
411	Bklyn Bridge City Hall	SUB	Island	No	ADA Clearance	-	-
412	Fulton Street	SUB	Side	Yes	-	$27.5M	$34.6M
413	Wall Street	SUB	Side	No	Columns too close to edge	-	-
414	Bowling Green	SUB	Side	Yes	-	$27.3M	$33.8M
415	Borough Hall	SUB	Side	No	Columns too close to edge	-	-
					Total	**$136.6M**	**$170.6M**

1.0 Station Assessments

1.01 – MR 337 | Nevins Street Station

***Summary:** Nevins Street Station is not feasible for both APGs and PSDs as the columns which are located 20" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description

Nevins Street Station is a below-grade station with two center / island platforms. The platform structures are cast-in-place concrete. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 20" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

***Figure 1** – Columns at 20" from platform edge*
Nevins Street Station

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1.02 – MR 338 | Atlantic Avenue Barclay Center Station

Summary: *Atlantic Avenue Barclay Ctr. Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Atlantic Avenue Barclay Ctr. is a below-grade station consisting of one center / island platform (the No. 2&3 trains utilize separate side platforms). This report concerns only the No. 4&5 train platform. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The column pictured in Figure 1 measures approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 16" from the edge*
Atlantic Avenue Barclay Ctr. Station

1.03 – MR 339 | Bergen Street Station

Summary: *Bergen Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Bergen Street Station is a below-grade station with two side platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are located only at the center of the platforms along the platform edge. Column faces measure approximately 3’-8” from the platform edge. The platform widths are approximately 7-10” throughout. Ceiling heights measure no less than 7’-6” throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the southbound control area of the station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27’-6” x 7’-0”.

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

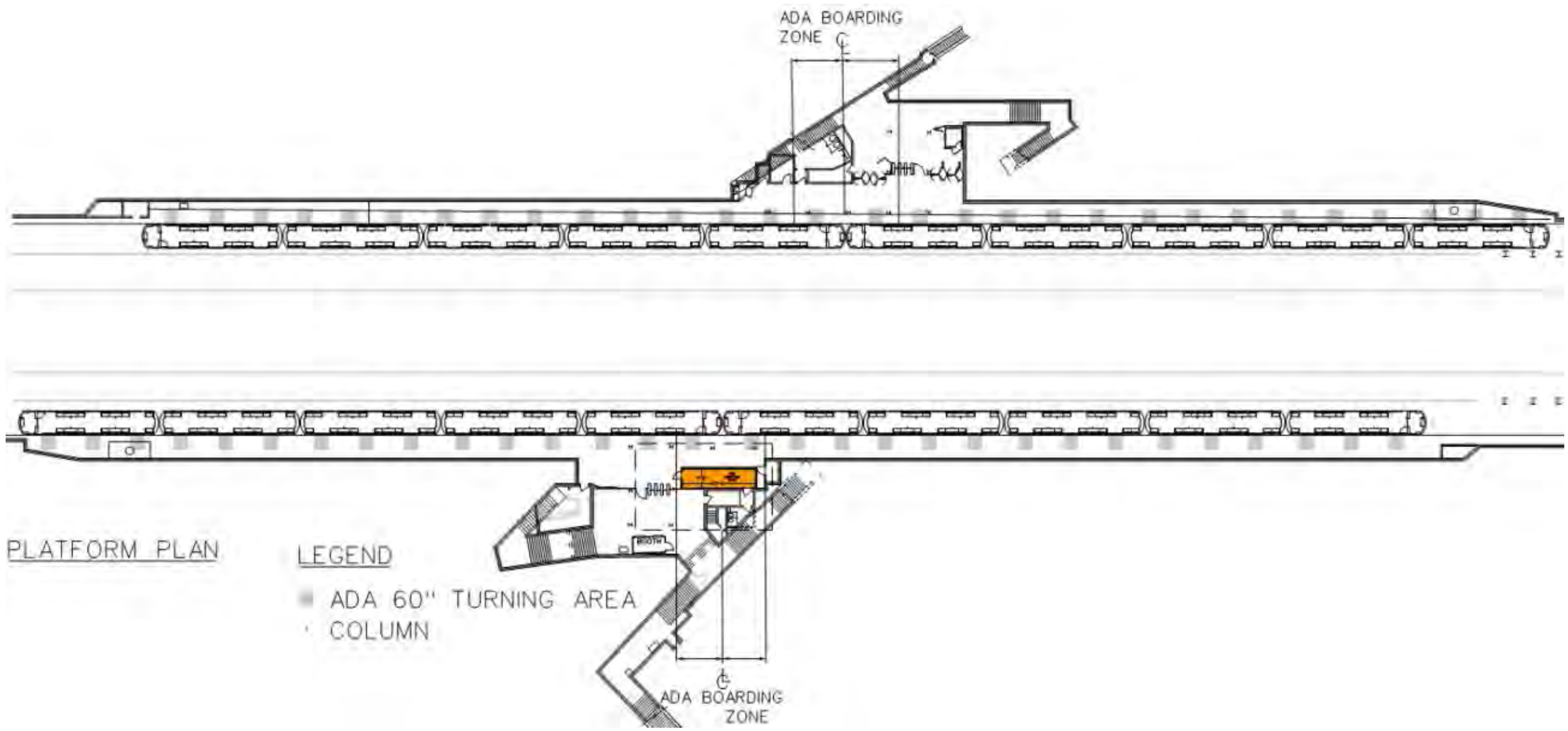

***Figure 1** – Overall Station Plan*
Bergen Street Station

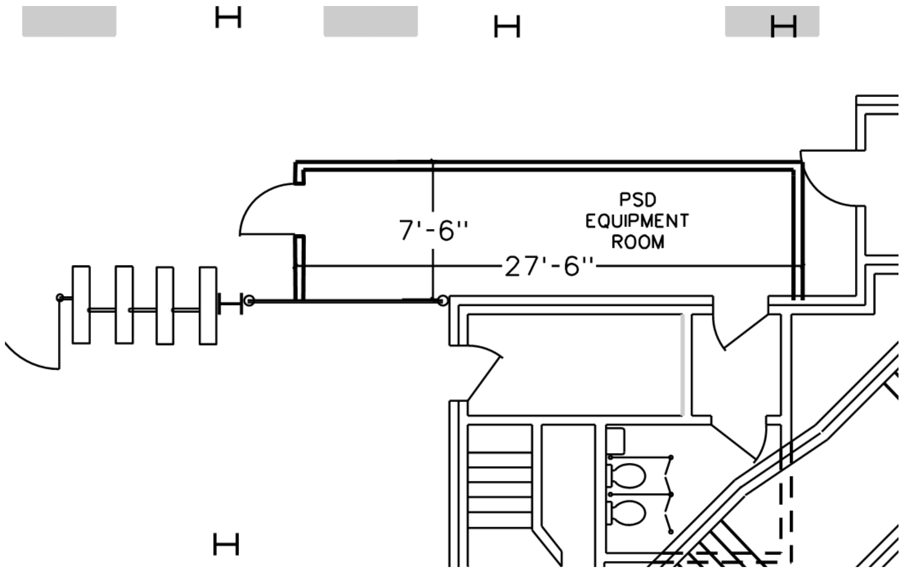

Figure 2 – *PSD Equipment Room 1 Detail*
Bergen Street Station

Figure 3 – *Typical platform view*
Bergen Street Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:
Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:
This station has adequate electrical capacity to support the implementation of an APG/PSD system. An analysis of electrical reserve service could not be performed due to inaccessibility during survey. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal Service)

Station Name	Bergen Street
Peak Demand Load from ConEd Report, (kW)	40.8
Apparent Power (kVA)	51.0
Station Peak Demand Load, Max Current, (A)	141.7
Maximum Amount of Doors	40.0
PSD Total Load Including All Miscellaneous Loads, (A)	121.6
Total Load (Station Peak + PSD), (A)	263
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	537
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 800A fuses at Service switch. The analysis is based on available Normal meter reading. (No access to Reserve room and no Reserve meter reading provided)

***Table 1**. Normal Service Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $26.9M to install APGs and $33.3M to install PSDs (See Appendix E)

1.04 – MR 340 | Grand Army Plaza Station

Summary: *Grand Army Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 29" (see figure 1).*

Description

The Grand Army Street Station is a below-grade station with one straight center / island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 32'-4" throughout. The corridor width at this station's western end is 44". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 29" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
Grand Army Plaza Station

1.05 – MR 341 | Eastern Parkway Station

Summary: *Eastern Parkway Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the northbound platform as the existing width is 5'-6" (see figure 1).*

Description

Eastern Parkway Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-6' to 11'-10".

Platform width at the ends of the platforms is 5'-6" or 66". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

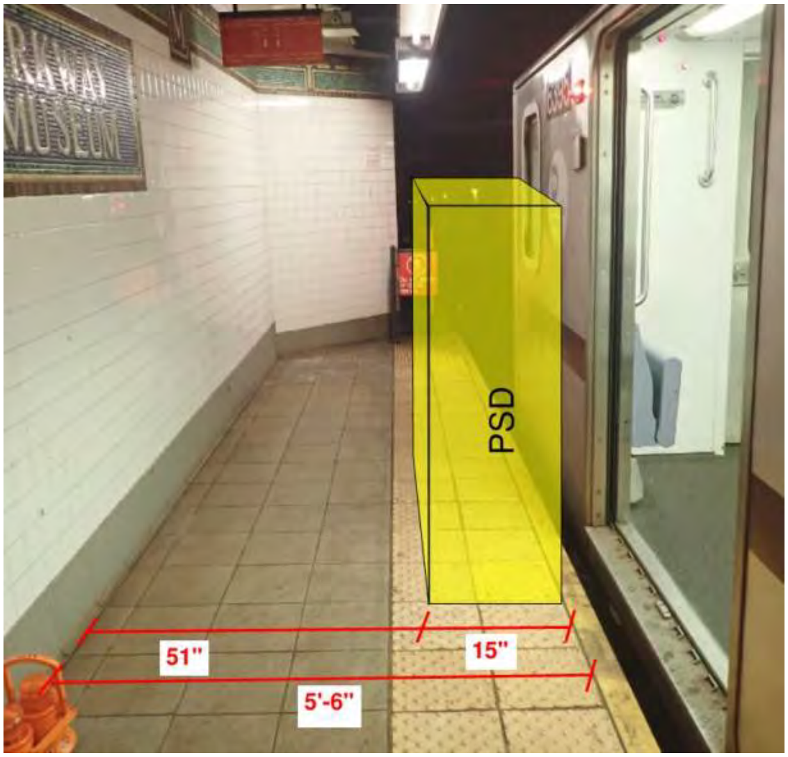

***Figure 1** – Non-Compliant egress condition*
Eastern Parkway Station

1.06 – MR 342 | Franklin Avenue Station

Summary: *Franklin Avenue Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Franklin Avenue Station is a below-grade station consisting of two center / island platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 16" from the edge*
Franklin Avenue Station

1.07 – MR 343 | Nostrand Avenue / Eastern Pkwy

Summary: *Nostrand Avenue Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

Nostrand Avenue Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. Platform widths vary from 7'-10" to 11'-10". There is a single row of columns on each platform.

Due to the limited width of the existing platforms, there is no available space for the equipment room. Figure 2 below shows the minimum width required (12'-11") for construction of a PSD equipment room on a station platform. Figure 1, below, demonstrates the lack of available space within the main control area.

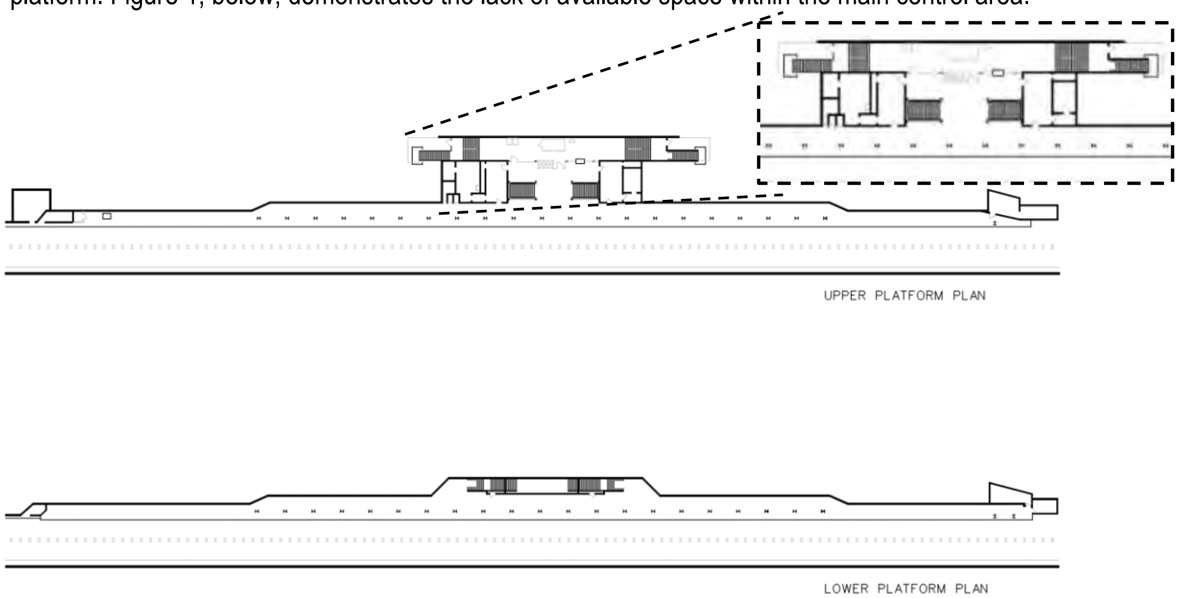

Figure 1 *– Congested/Narrow Station Plan*
Nostrand Avenue Eastern Pkwy

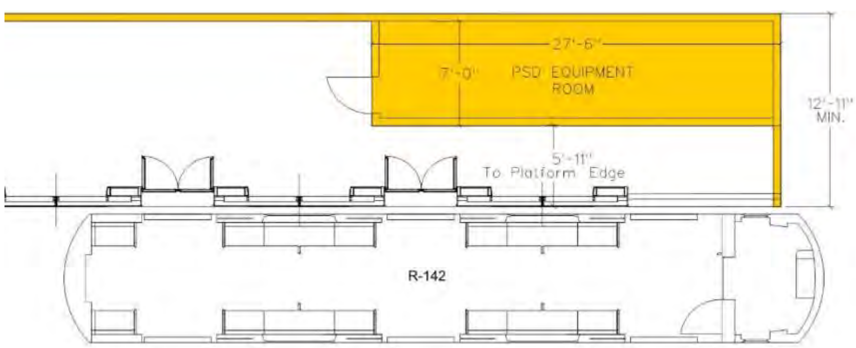

Figure 2 – *Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimension

1.08 – MR 344 | Kingston Avenue

Summary: *Kingston Avenue Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

Kingston Avenue Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. Platform widths vary from 7'-10" to 11'-10". There is a single row of columns on each platform.

Due to the limited width of the existing platforms, there is no available space for the equipment room. Figure 2 below shows the minimum width required (12'-11") for construction of a PSD equipment room on a station platform. Figure 1, below, demonstrates the lack of available space within the main control area.

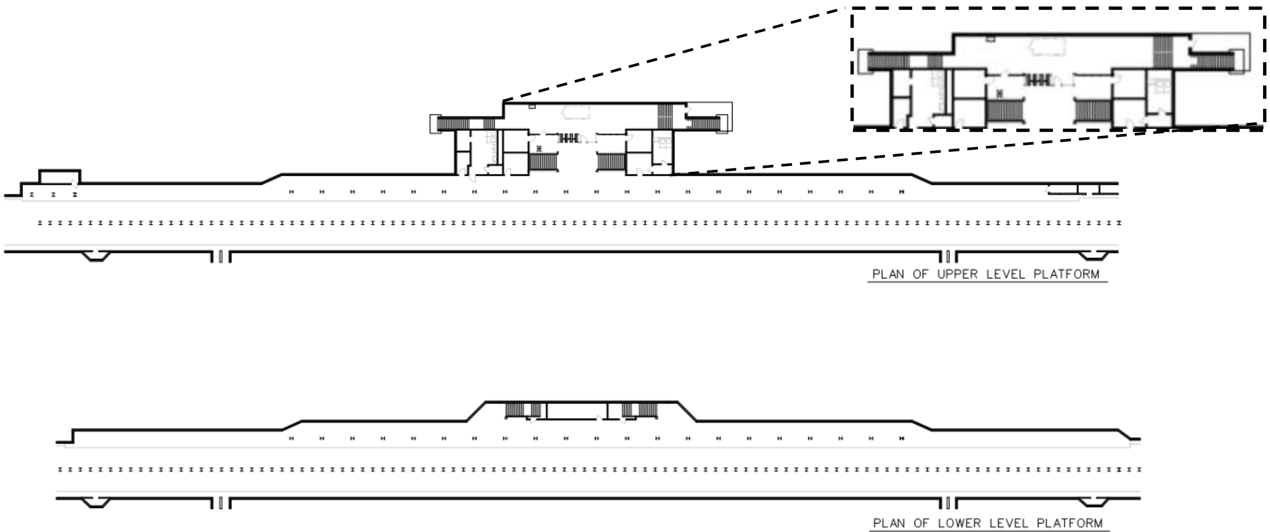

Figure 1 *– Congested/Narrow Station Plan*
Kingston Avenue

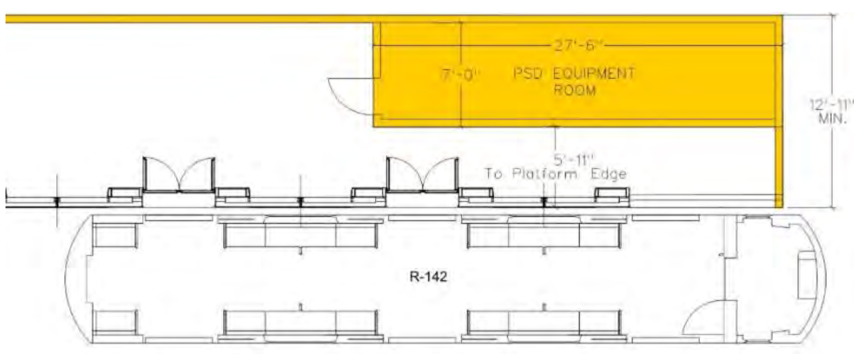

Figure 2 – *Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimension

1.09 – MR 345 | Crown Heights / Utica Avenue

Summary: *Crown Heights Station is not feasible for both APGs and PSDs as the columns which are located 12" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Crown Heights Station is a below-grade station consisting of two center / island platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platform which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 12" from the platform edge. This dimension does not allow for installation and maintenance of the 15"-wide APG/PSD system. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 12" from the edge*
Crown Heights Utica Avenue

1.10 – MR 346 | Sutter Avenue

Summary: *Sutter Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Sutter Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 8'-10" to 9'-10". The platforms are straight with one row of columns inset in the windscreen. See figure 1 & 2 for reference.

***Figure 1** – General Station Condition*
Sutter Avenue Station

***Figure 2** – Precast Slab*
Sutter Avenue Station

1.11 – MR 347 | Saratoga Avenue / Livonia Avenue

Summary: Saratoga Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).

Description

The Saratoga Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 9'-10" throughout. The platforms are straight with one row of columns inset in the windscreen. See figure 1 & 2 for reference.

***Figure 1** – General Station Condition*
Saratoga Avenue Station

***Figure 2** – Precast Slab*
Saratoga Avenue Station

1.12 – MR 348 | Rockaway Avenue

Summary: *Rockaway Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Rockaway Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 9'-8" throughout. The platforms are straight with one row of columns inset in the windscreen. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Rockaway Avenue Station

Figure 2 *– Precast Slab*
Rockaway Avenue Station

1.13 – MR 349 | Junius Street

Summary: *Junius Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Junius Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 9'-10" throughout. The platforms are straight with one row of columns inset in the windscreen. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Junius Street Station

Figure 2 *– Precast Slab*
Junius Street Station

1.14 – MR 350 | Pennsylvania Avenue

Summary: *Pennsylvania Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Pennsylvania Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 9'-10" throughout. The platforms are straight with one row of columns inset in the windscreen. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Pennsylvania Avenue Station

Figure 2 *– Precast Slab*
Pennsylvania Avenue Station

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1.15 – MR 351 | Van Siclen Avenue Station

Summary: *Van Siclen Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Van Siclen Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 9'-10" throughout. The platforms are straight with one row of columns inset in the windscreen. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Van Siclen Avenue Station

Figure 2 *– Precast Slab*
Van Siclen Avenue Station

1.16 – MR 352 | New Lots Avenue Station

Summary: *New Lots Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The New Lots Avenue Station is an elevated station with one center / island platform. The platform structure is precast concrete. The width of the platforms is approximately 15'-0" throughout. The platform is straight with one row of columns supporting the station canopy. See figure 1 for reference.

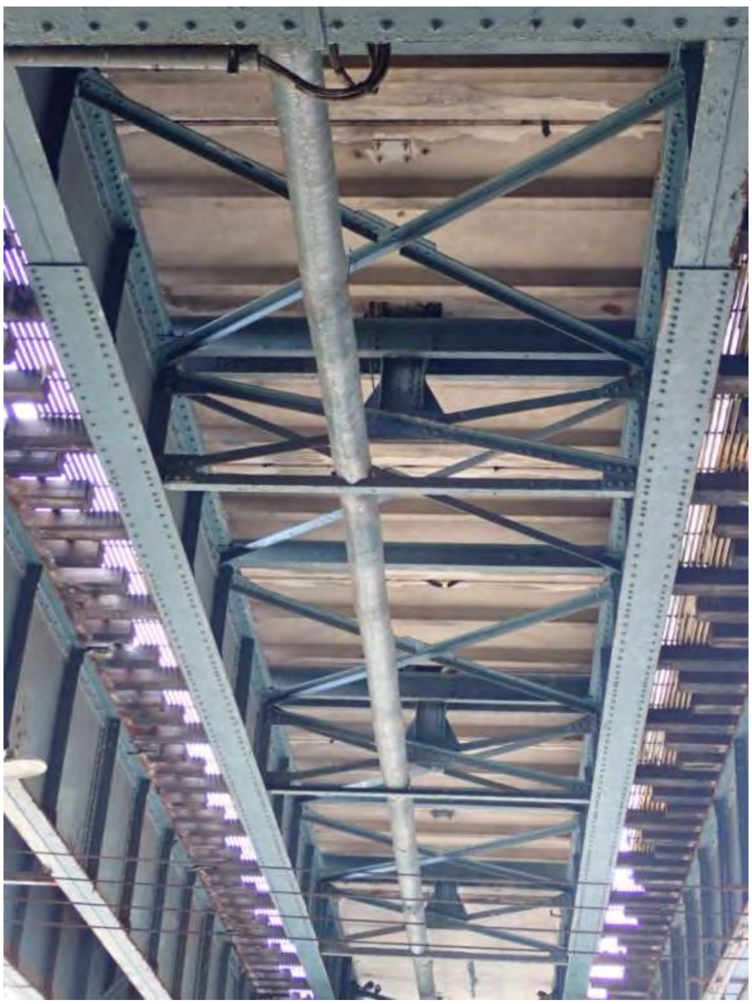

Figure 1 *– Precast Slab*
New Lots Avenue Station

1.17 – MR 378 | Woodlawn

Summary: *Woodlawn Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

Woodlawn Station is an elevated station with one center platform. The platform structure is precast concrete. The width of the platforms is approximately 9'-10" throughout. The platform is straight with one row of columns centered to support the roof. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Woodlawn Station

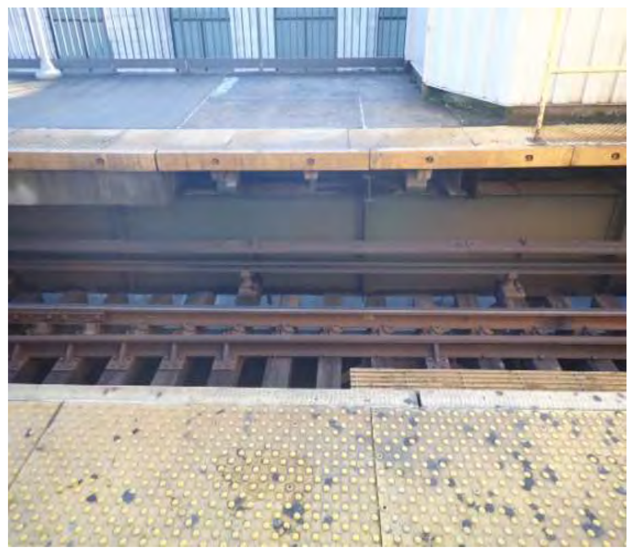

Figure 2 *– Precast Slab*
Woodlawn Station

1.18 – MR 379 | Mosholu Parkway

Summary: *Mosholu Parkway Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Mosholu Parkway Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 14'-10" throughout. The platforms are straight with one row of columns inset in the windscreen and another set adjacent to the platform edge. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Mosholu Parkway Station

Figure 2 *– Precast Slab*
Mosholu Parkway Station

1.19 – MR 380 | Bedford Park Boulevard – Lehman College

Summary: *Bedford Park Boulevard Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Bedford Park Boulevard Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 12'-0" throughout. The platforms are straight with one row of columns inset in the windscreen and another set adjacent to the platform edge. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Bedford Park Boulevard Station

Figure 2 *– Precast Slab*
Bedford Park Boulevard Station

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1.20 – MR 381 | Kingsbridge Road

Summary: *Kingsbridge Road Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Kingsbridge Road Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 11'-10" throughout. The platforms are straight with one row of columns inset in the windscreen and another set adjacent to the platform edge. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Kingsbridge Road Station

Figure 2 *– Precast Slab*
Kingsbridge Road Station

1.21 – MR 382 | Fordham Road

Summary: *Fordham Road Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Fordham Road Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 11'-10" throughout. The platforms are straight with one row of columns inset in the windscreen and another set adjacent to the platform edge. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Fordham Road Station

Figure 2 *– Precast Slab*
Fordham Road Station

1.22 – MR 383 | 183rd Street

Summary: *183rd Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The 183rd Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 12'-4" throughout. The platforms are straight with one row of columns inset in the windscreen and another set adjacent to the platform edge. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
183rd Street Station

Figure 2 *– Precast Slab*
183rd Street Station

1.23 – MR 384 | Burnside Avenue

Summary: *Burnside Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Burnside Avenue Station is an elevated station with two center / island platforms. The platform structures are precast concrete. The width of the platforms is approximately 15'-4" throughout. The platforms are straight with one row of columns centered to support the roof. See figure 1 & 2 for reference.

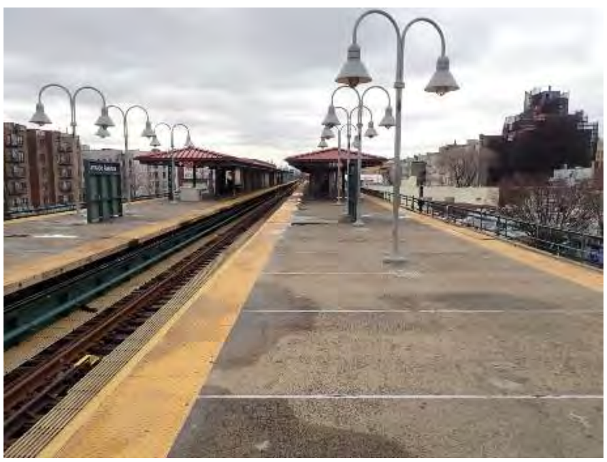

Figure 1 *– General Station Condition*
Burnside Avenue Station

Figure 2 *– Precast Slab*
Burnside Avenue Station

1.24 – MR 385 | 176th Street

Summary: *176th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The 176th Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 11'-8" throughout. The platforms are straight with one row of columns inset in the windscreen and another set adjacent to the platform edge. See figure 1 & 2 for reference.

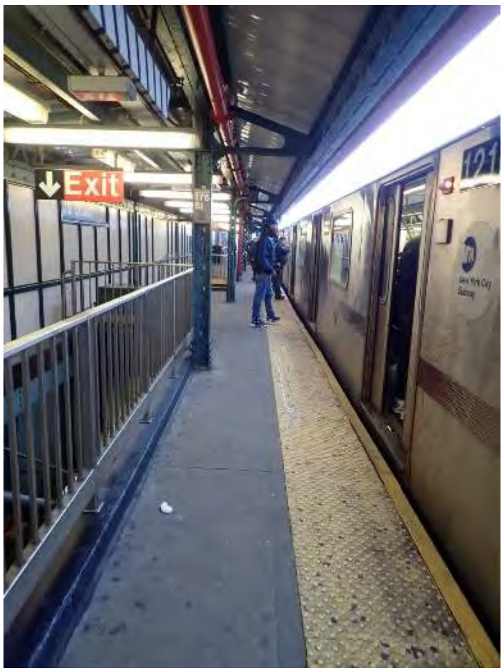

***Figure 1** – General Station Condition*
176th Street Station

***Figure 2** – Precast Slab*
176th Street Station

1.25 – MR 386 | Mt. Eden Avenue

Summary: *Mt. Eden Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Mt. Eden Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 12'-0" throughout. The platforms are straight with one row of columns inset in the windscreen and another set adjacent to the platform edge. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Mt. Eden Avenue Station

Figure 2 *– Precast Slab*
Mt. Eden Avenue Station

1.26 – MR 387 | 170th Street

Summary: *170th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The 170th Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 12'-0" throughout. The platforms are straight with one row of columns inset in the windscreen and another set adjacent to the platform edge. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
170th Street Station

Figure 2 *– Precast Slab*
170th Street Station

1.27 – MR 388 | 167th Street

***Summary:** 167th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The 167th Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 12'-2" throughout. The platforms are straight with one row of columns inset in the windscreen and another set adjacent to the platform edge. See figure 1 & 2 for reference.

***Figure 1** – General Station Condition*
167th Street Station

***Figure 2** – Precast Slab*
167th Street Station

1.28 – MR 389 | 161st Street Yankee Stadium

Summary: *161st Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The 161st Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 11'-6" throughout. The platforms are straight with one row of columns inset in the windscreen and another set adjacent to the platform edge. See figure 1 & 2 for reference.

***Figure 1** – General Station Condition*
161st Street Station

***Figure 2** – Precast Slab*
161st Street Station

1.29 – MR 390 | 149th Street Grand Concourse

Summary: *The 149th Street Grand Concourse Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the northbound platform as the existing width is 4'-6" (see figure 1).*

Description

The 149th Street Grand Concourse Upper Level Station is a below-grade station with two straight center/island platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 4'-6' to 19'-6".

The platform width at the southbound end of the northbound platform is 4'-6" or 54". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

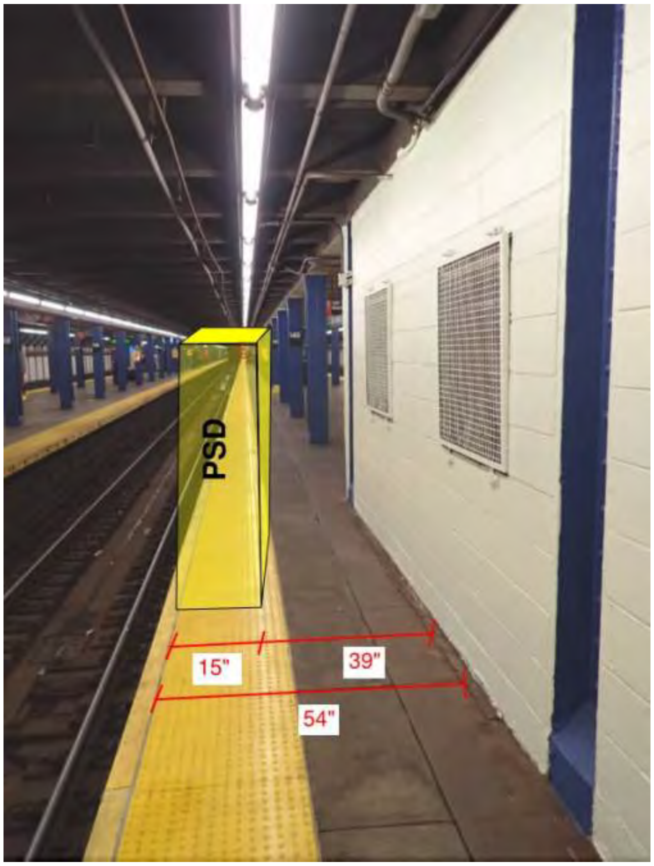

***Figure 1** – Non-Compliant egress condition*
149th Street Grand Concourse Station

1.30 – MR 391 | 138th Street Grand Concourse

Summary: *138th Street Grand Concourse Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

The 138th Street Grand Concourse Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-4' to 11'-6". The implementation of a platform edge barrier would reduce the lesser width below the required minimum of 36". The remaining 25" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-compliant ADA condition*
138th Street Grand Concourse Station

1.31 – MR 392 | 125th Street

Summary: *125th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

125th Street Station is a below-grade station with two levels of straight center / island platforms. The no. 4 train utilizes both the upper and lower level. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-4' to 29'-8". At the lower platform, the implementation of a platform edge barrier would reduce the lesser width below the required minimum of 36". The remaining 25" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

The upper platform is infeasible for both APGs and PSDs due to the presence of structural columns on the platform which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 2 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA clearance*
North end of lower platform; 125th Street Station

Figure 2 *– Columns at 16" from platform edge*
South end of upper platform

1.32 – MR 393 | 116th Street

Summary: *116th Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

116th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. Platform widths vary from 7'-8" to 11'-10". There is a single row of columns on each platform.

Due to the limited width of the existing platforms, there is no available space for the equipment room. Figure 2 below shows the minimum width required (12'-11") for construction of a PSD equipment room on a station platform. Figure 1, below, demonstrates the lack of available space within the main control area.

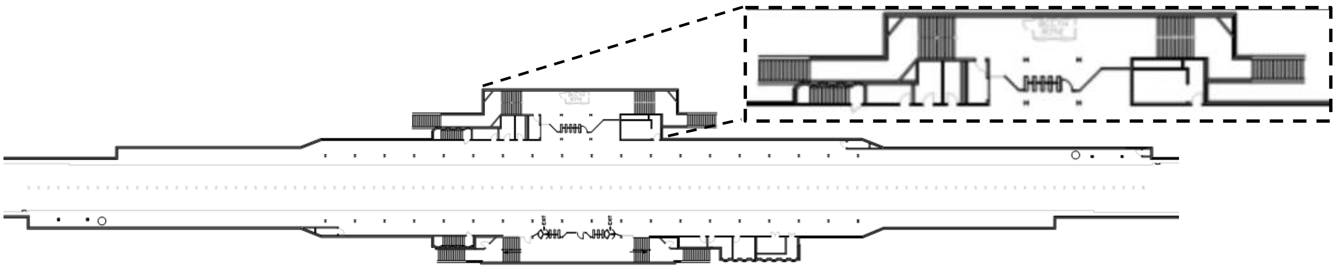

***Figure 1** – Congested/Narrow Station Plan*
116th Street Station

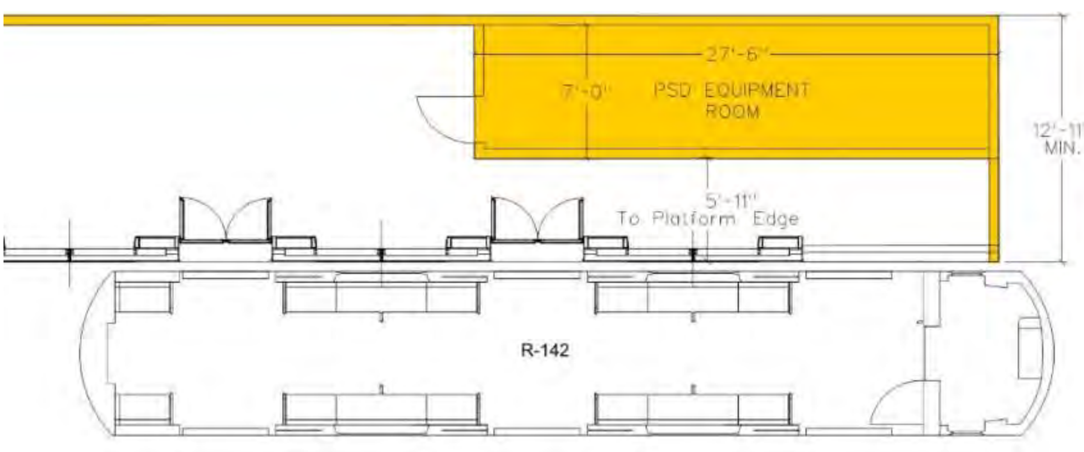

***Figure 2** – Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimension

1.33 – MR 394 | 110th Street

Summary: *110th Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

110th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. Platform widths vary from 7'-8" to 8'-0". There is a single row of columns on each platform.

Due to the limited width of the existing platforms, there is no available space for the equipment room. Figure 2 below shows the minimum width required (12'-11") for construction of a PSD equipment room on a station platform. Figure 1, below, demonstrates the lack of available space within the main control area.

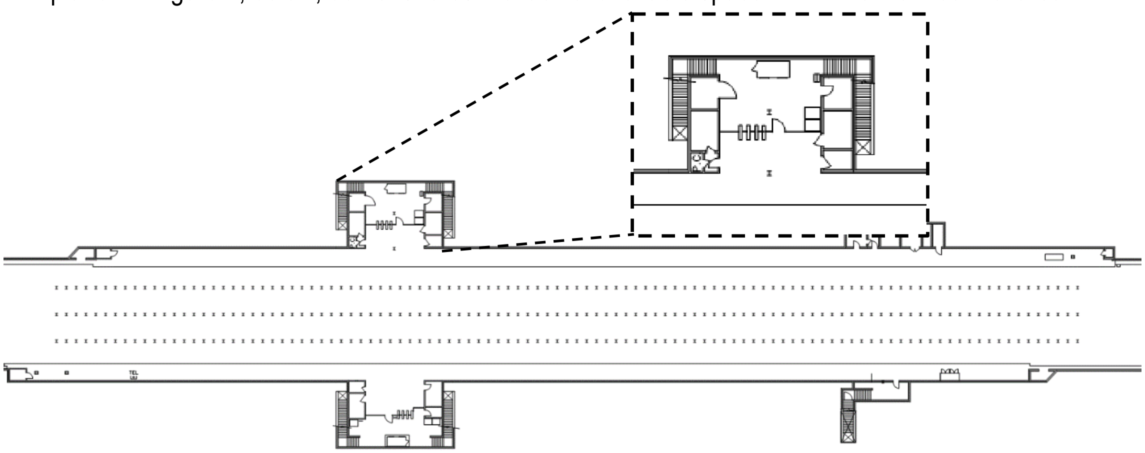

***Figure 1** – Congested/Narrow Station Plan*
110th Street Station

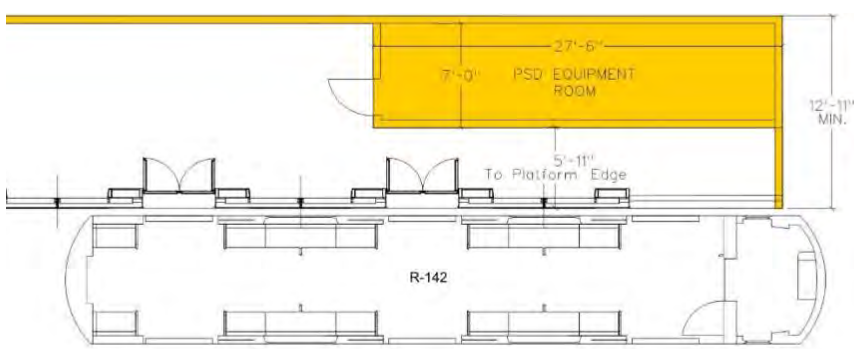

***Figure 2 –** Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimension

1.34 – MR 395 | 103rd Street

Summary: *103rd Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

103rd Street Station is a below ground station with two side platforms (**see Figure 1**). The platform structures are cast-in-place concrete. There are no columns located throughout the platforms. The platform widths are approximately 7-4" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the mezzanine control area of the station (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

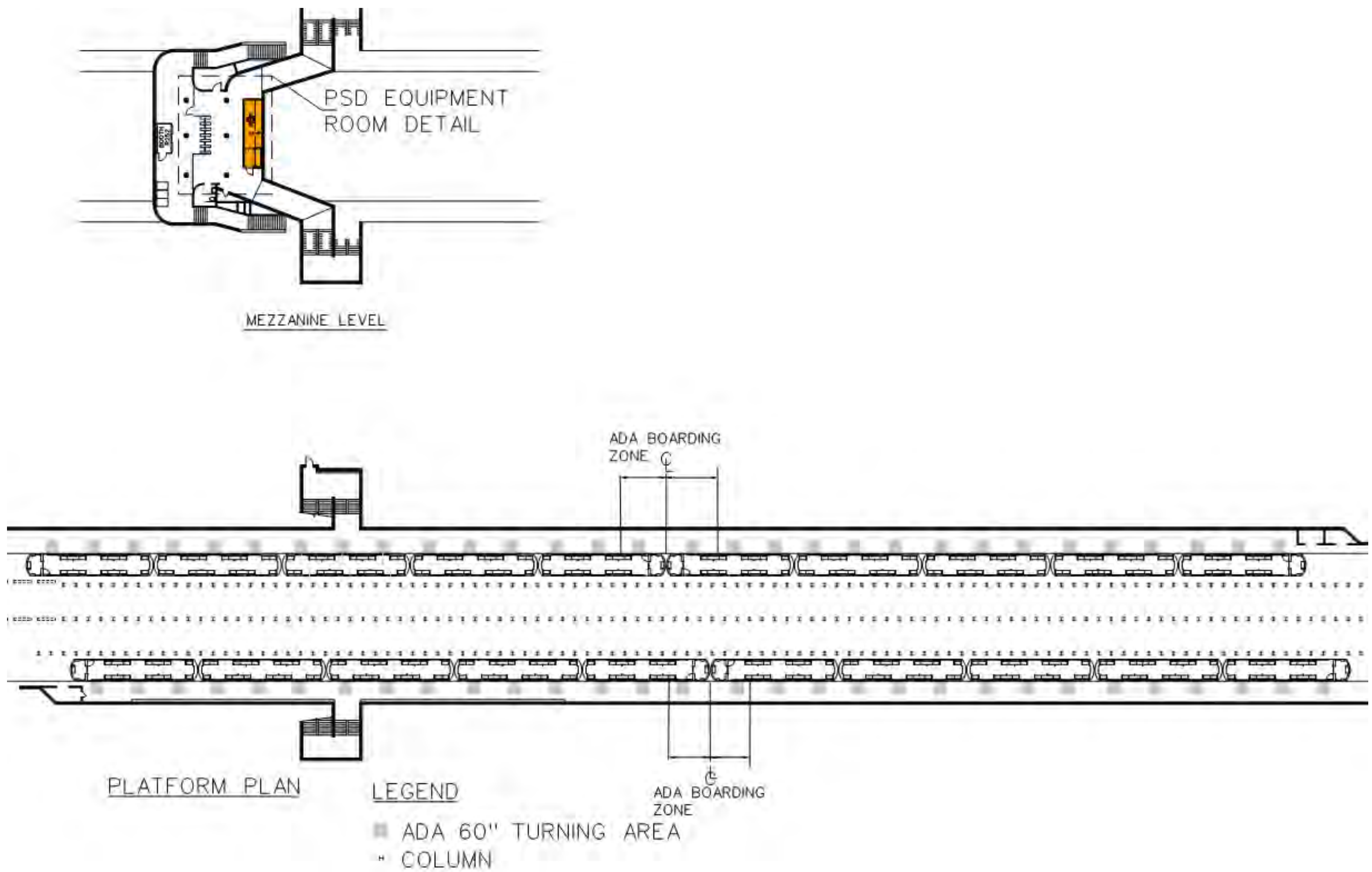

Figure 1 *– Overall Station Plan*
103rd Street Station

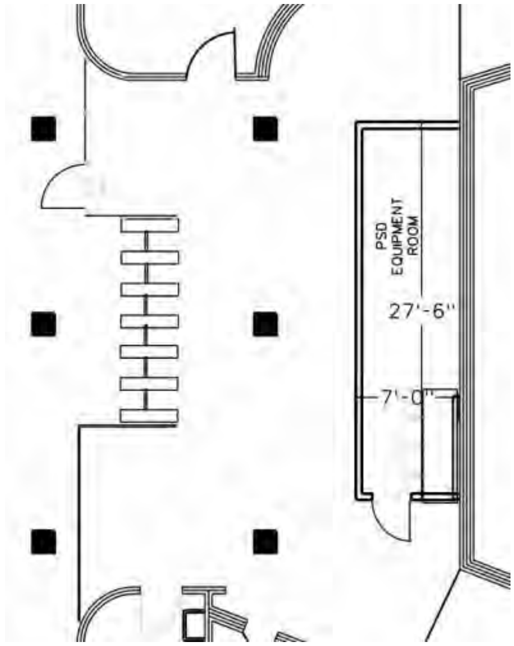

Figure 2 *– PSD Equipment Room 1 Detail*
103rd Street Station

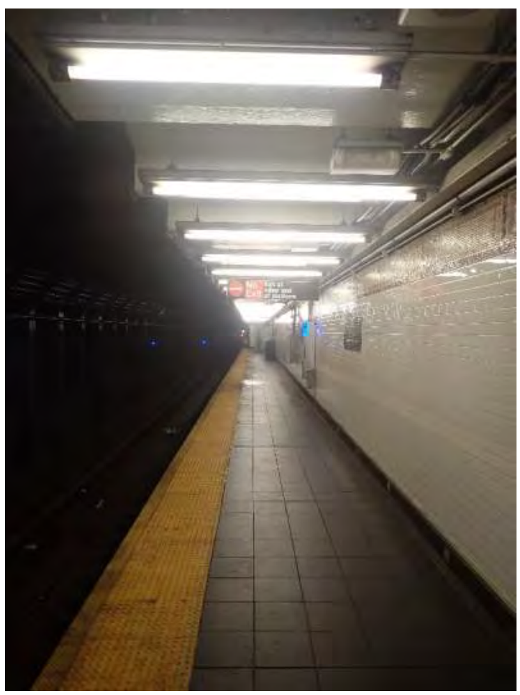

Figure 3 *– Typical platform view*
103rd Street Station

Platform obstructions within 5' of edge:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. An analysis of electrical reserve service could not be performed due to inaccessibility during survey. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal service)

Station Name	103rd Street
Peak Demand Load from ConEd Report, (kW)	26.8
Apparent Power (kVA)	33.5
Station Peak Demand Load, Max Current, (A)	93.1
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	251.2
Station Service Power Capacity, (Main SB or SG Rating), (A)	400.0
Service Spare Capacity, (A)	148.9
Is Electrical Service Adequate?	**Yes**
Notes	Service rating of 400A is based on field observations. Station has only (1) meter readings for Normal service. The station Reserve meter was NOT accessible during field survey. (No meter in Reserve EDR) 1 Line diagram provided is not current.

***Table 1**. Normal Service Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.6M to install APGs and $34.5M to install PSDs (See Appendix E)

1.35 – MR 396 | 96th Street

Summary: *96th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the north end of the southbound platform as the existing width is 5'-0" (see figure 1).*

Description

96th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-0' to 12'-10".

The platform width at the end of the southbound platform is 5'-0" or 60". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

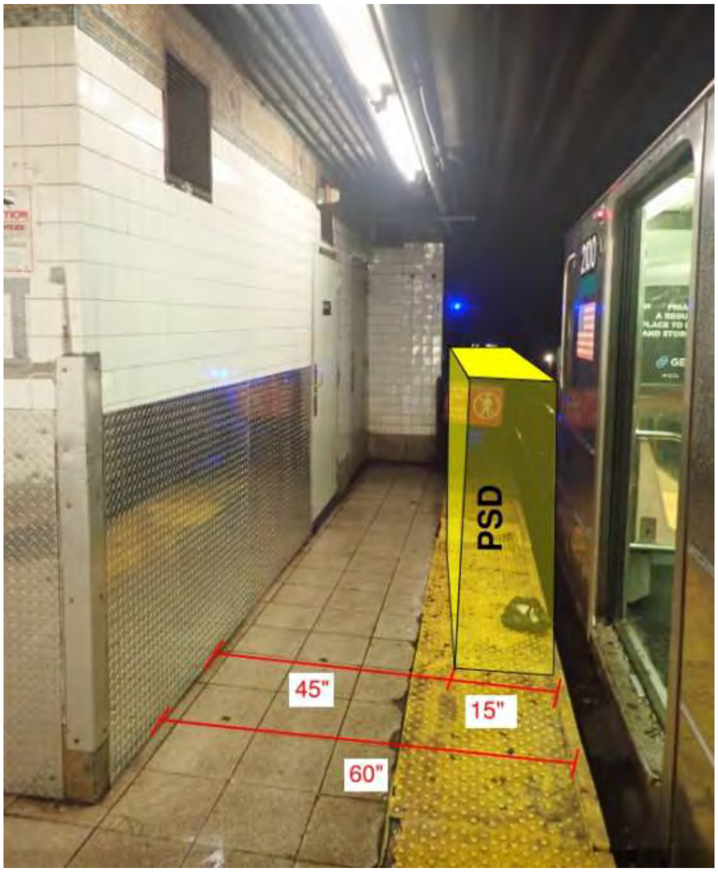

Figure 1 *– Non-Compliant egress condition*
96th Street Station

1.36 – MR 397 | 86th Street

Summary: *86th Street is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at the center stairs as the remaining width would be 31" (see figure 1).*

Description

The 86th Street Station is a below-grade station consisting of two side platforms on two levels. The No. 4 service normally runs at the lower level, with night service on the upper level. At the upper level, the platforms are approximately 13'-8" wide. The platforms are straight with one rows of columns at 46" from the edge of the platform. The implementation of a platform edge barrier would reduce this width to 31" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

The 86th Street lower level is infeasible due to lack of space for a PSD equipment room. The introduction of an equipment room on the lower platform would create 24" pinch points at the columns which do not comply with the minimum 32" required by ADA.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA dimension*
86th Street Station

1.37 – MR 398 | 77th Street

Summary: *77th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

The 77th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-4' to 11'-8". The implementation of a platform edge barrier would reduce the lesser width below the required minimum of 36". The remaining 25" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-compliant ADA condition*
77th Street Station

1.38 – MR 399 | 68th Street Hunter College

__Summary:__ 68th Street Hunter College Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of both platforms as the existing width is 4'-2" (see figure 1).

Description

68th Street Hunter College Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 4'-2' to 11'-10".

Platform width at the southbound end of the northbound & southbound platform is 4'-2" or 50". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

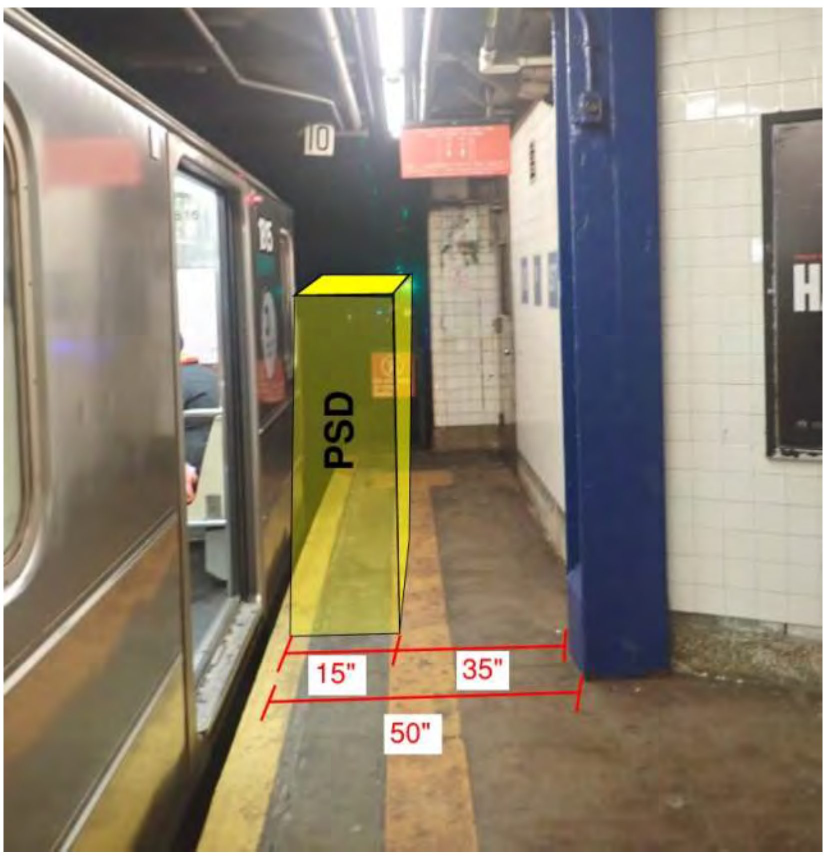

***Figure 1** – Non-Compliant egress condition*
68th Street Hunter College Station

1.39 – MR 400 | 59th Street

Summary: *59th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

The 59th Street Station is a below-grade station with two levels of two straight side platforms. The No. 4 service runs normally on the lower platform, with night service on the upper platform. The upper level platform will be the subject of a future report for the No. 6 line. The platform structures are cast-in-place concrete. The width of the lower level platforms ranges from 3'-4' to 13'-0". The implementation of a platform edge barrier would reduce the lesser width below the required minimum of a 32" pinch point. The remaining 25" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

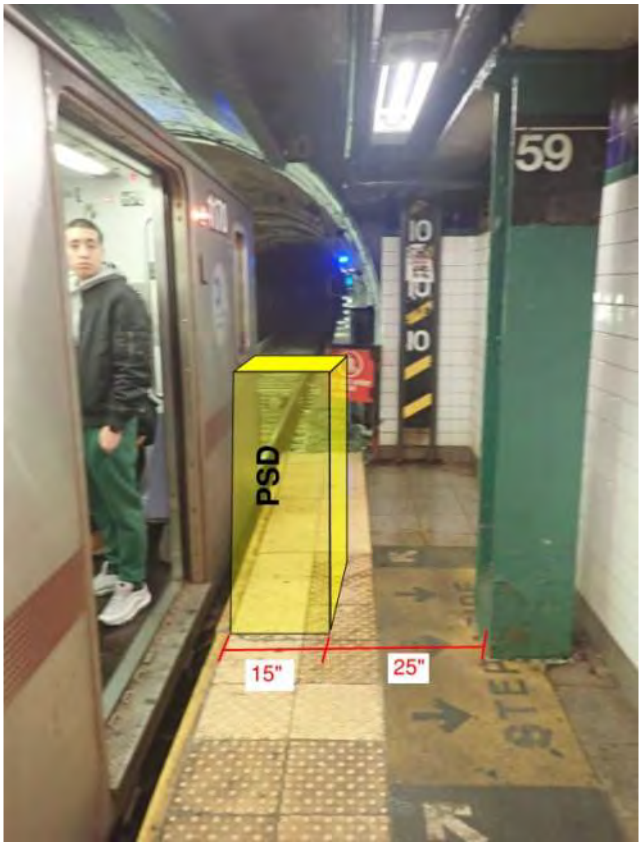

Figure 1 *– Non-Compliant egress condition*
59th Street Station- lower level

1.40 – MR 401 | 51st Street

Summary: *51st Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

51st Street Station is a below-grade station with two side platforms (**see Figure 1**). The platform structures are cast-in-place concrete. Columns are located throughout the platforms along the platform edge. Column faces measure approximately 3'-8" from the platform edge. The platform widths are approximately 11-4" to 20'-0". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the north end of the northbound platform (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

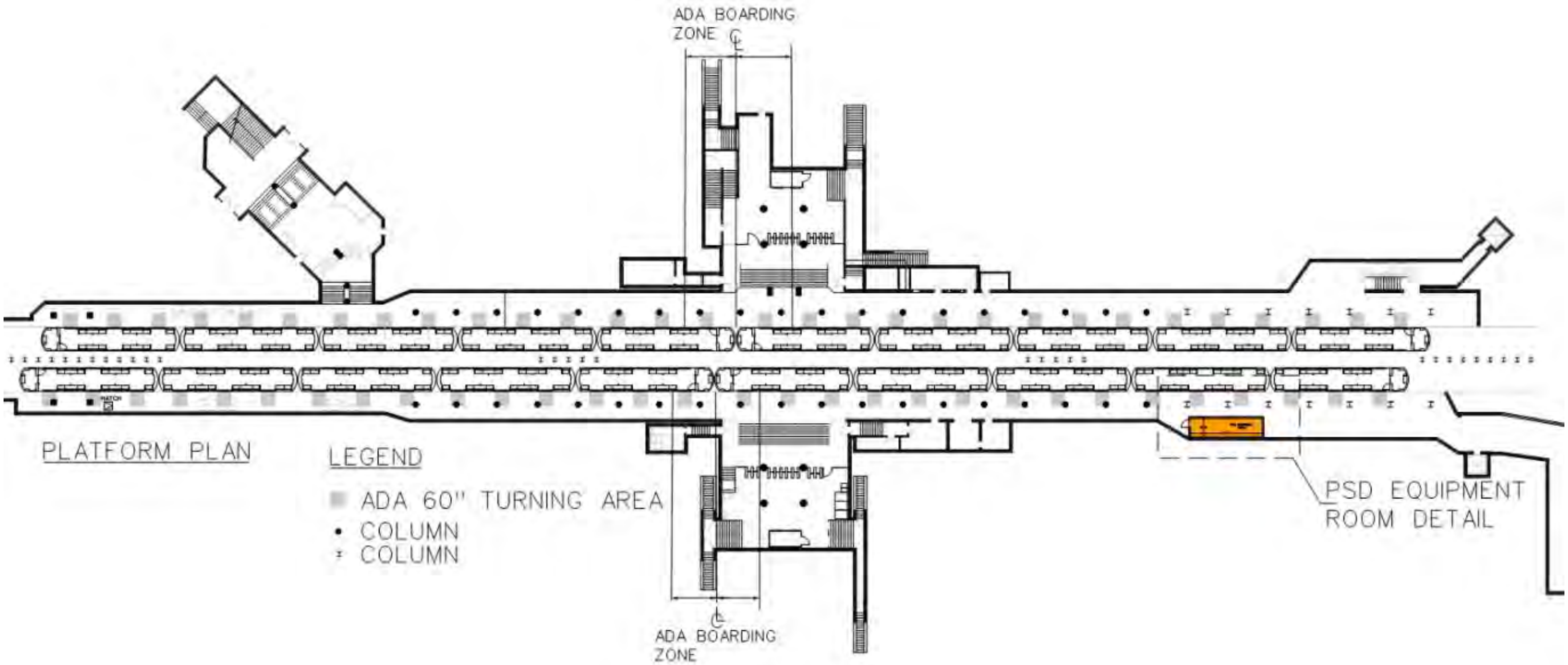

Figure 1 *– Overall Station Plan*
51st Street Station

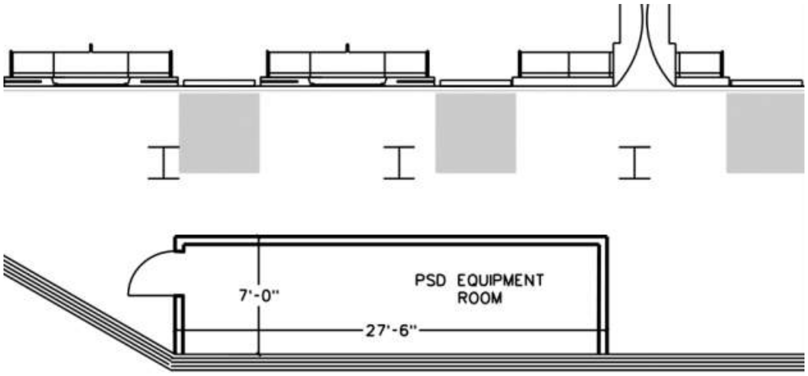

***Figure 2** – PSD Equipment Room 1 Detail*
51st Street Station

***Figure 3** – Typical platform view*
51st Street Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 & Table 2 see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal Service)

Station Name	51st Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	28.8
Apparent Power (kVA)	36.0
Station Peak Demand Load, Max Current, (A)	100.0
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	258.1
Station Service Power Capacity, (Main SB or SG Rating), (A)	600
Service Spare Capacity, (A)	342
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey and 1 line diagram, having 600 A Service switch. Station has (2) separate meter readings for each Normal & Reserve service. 1 Line diagram provided is not current.

***Table 1**. Normal Service Power Capacity Analysis*

Station
Power Capacity Analysis (Reserve Service)

Station Name	51st Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	55.0
Apparent Power (kVA)	68.8
Station Peak Demand Load, Max Current, (A)	191.0
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	349
Station Service Power Capacity, (Main SB or SG Rating), (A)	700
Service Spare Capacity, (A)	351
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey and 1 line diagram having 700A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service.

Table 2. Reserve Service Power Capacity Analysis

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.3M to install APGs and $34.4M to install PSDs (See Appendix E)

1.41 – MR 402 | 42nd Street Grand Central

Summary: *42nd Street Grand Central Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 31" (see figure 1).*

Description

The 42nd Street Grand Central Station is a below-grade station with two straight center / island platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-10' to 24'-0". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 31" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

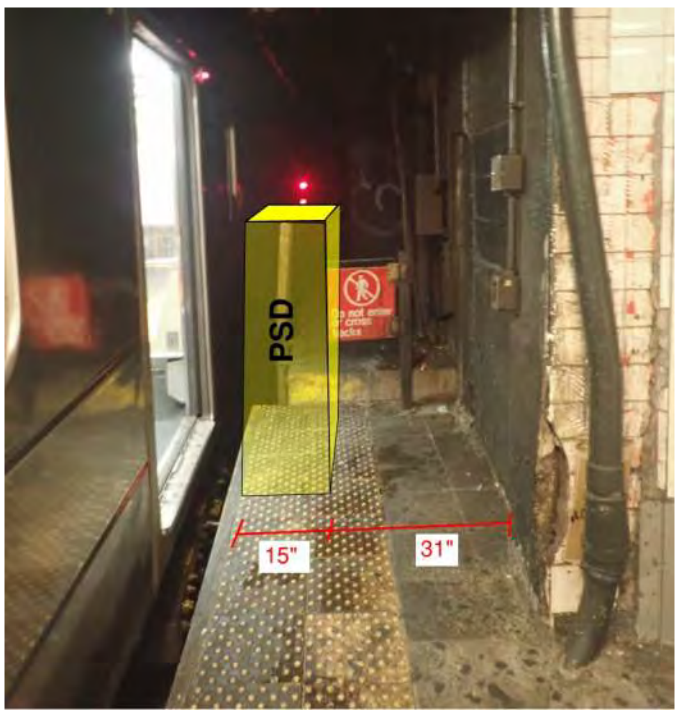

Figure 1 *– Non-compliant ADA condition*
42nd Street Grand Central Station

1.42 – MR 403 | 33rd Street

Summary: *33rd Street Station is not feasible for both APGs and PSDs as the columns which are located 18" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

33rd Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 18" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 18" from the edge*
33rd Street Station

1.43 – MR 404 | 28th Street

Summary: *28th Street Station is not feasible for both APGs and PSDs as the columns which are located 14" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

28th Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The column pictured in Figure 1 measures approximately 14" from the platform edge. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 14" from the edge*
28th Street Station

1.44 – MR 405 | 23rd Street

Summary: *23rd Street Station is not feasible for both APGs and PSDs as the columns which are located 14" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

23rd Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 14" from the platform edge. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 14" from the edge*
23rd Street Station

1.45 – MR 406 | 14th Street Union Square

Summary: *14th Union Square Station is not feasible for both APGs and PSDs due to the presence of platform edge gap fillers located at all southbound platform edges. The existing gap fillers are a dynamic assembly that extends the platform edge when a train arrives, and recedes when the train departs. This moving assembly prevents the installation of a static PSD system. Please see figure 1 for reference.*

Description:

Due to the sharp curvature of the platforms at 14th Street Union Square, platform edge gap fillers are necessary to bridge the gap between the current rolling stock's doors and the platform edge.

Figure 1 *–Platform Edge Gap Fillers*
14th Street Union Square Station

1.46 – MR 407 | Astor Place 4th Avenue

Summary: *Astor Place Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 15" (see figure 1).*

Description

The Astor Place Station is a below-grade station with two curved side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 2'-6' to 10'-8". The implementation of a platform edge barrier would reduce this lesser width below the required minimum of 32". The remaining 15" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.=

Figure 1 *– Non-compliant ADA condition*
Astor Place Station

1.47 – MR 408 | Bleeker St.

Summary: *Bleeker St. Station is not feasible for both APGs and PSDs as the columns which are located 18" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Bleeker Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 18" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 18" from the edge*
Bleeker St. Broadway Lafayette Station

1.48 – MR 409 | Spring St.

Summary: *Spring St. Station is not feasible for both APGs and PSDs as the columns which are located 22" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Spring St. Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 22" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 22" from the edge*
Spring St. Station

1.49 – MR 410 | Canal Street

Summary: *Canal Street Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Canal Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 16" from the edge*
Canal Street Station

1.50 – MR 411 | Brooklyn Bridge City Hall

Summary: *Brooklyn Bridge City Hall Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at the center stairs as the remaining width would be 17" (see figure 1).*

Description

The Brooklyn Bridge City Hall Station is a below-grade station consisting of two center / island platforms. The platforms are approximately 15'-6" to 21'-2" wide. The platforms are mildly curved with two rows of columns at 32" from the edge of the platform. The implementation of a platform edge barrier would reduce this width to 17" or less* which would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
Brooklyn Bridge City Hall Station

1.51 – MR 412 | Fulton Street

Summary: *Fulton Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Fulton Street Station is a below-grade station with two side platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are located throughout the platforms along the platform edge. Column faces measure approximately 3'-2" from the platform edge. The platform widths range from approximately 7'-6" to 19'-4" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located on the southbound platform of the station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past five years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for '4' Line Stations
(Fulton Street Station)

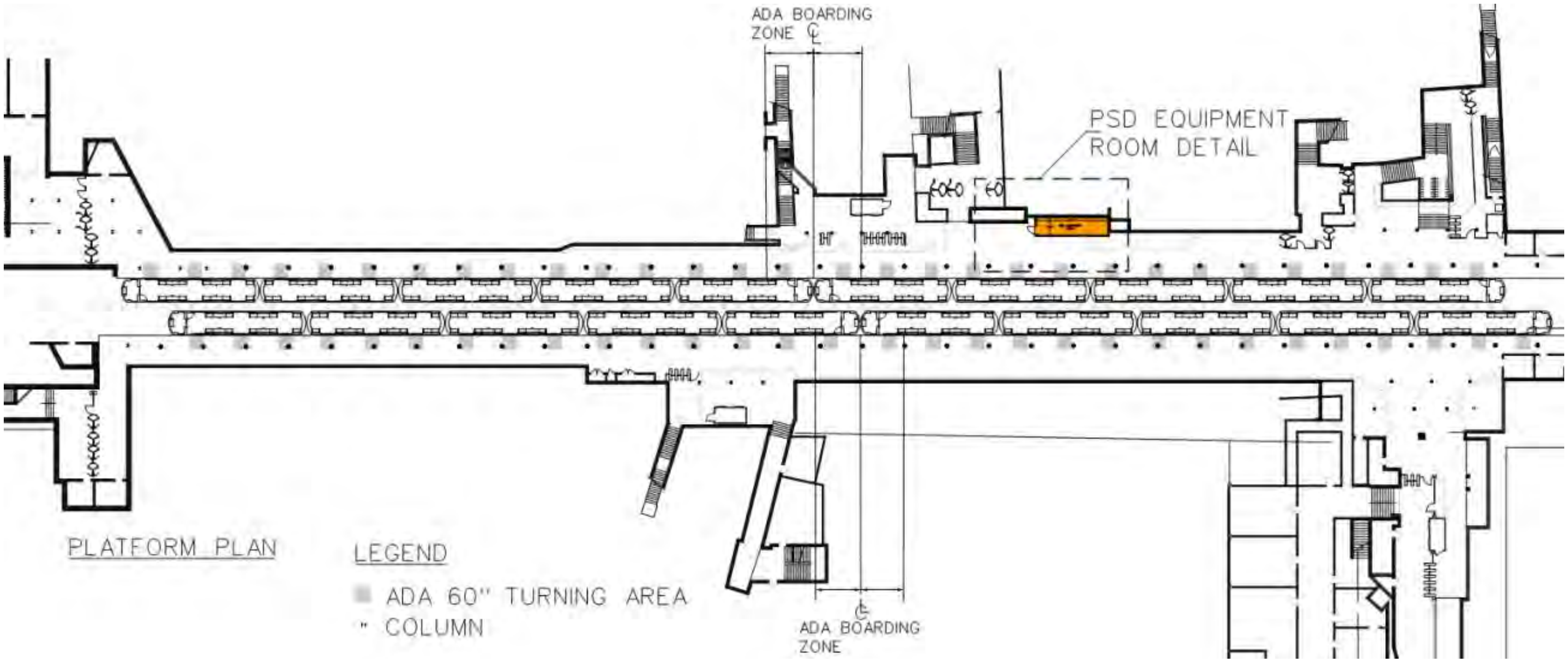

Figure 1 – Overall Station Plan
Fulton Street Station

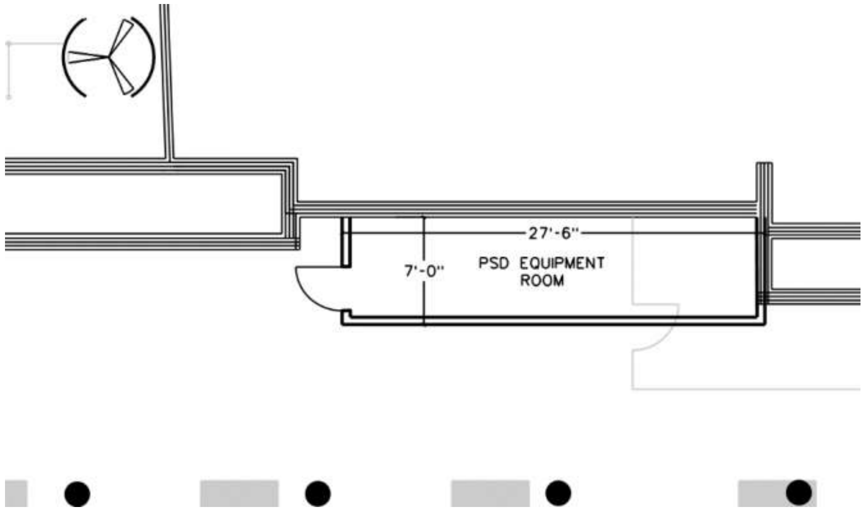

Figure 2 *– PSD Equipment Room 1 Detail*
Fulton Street Station

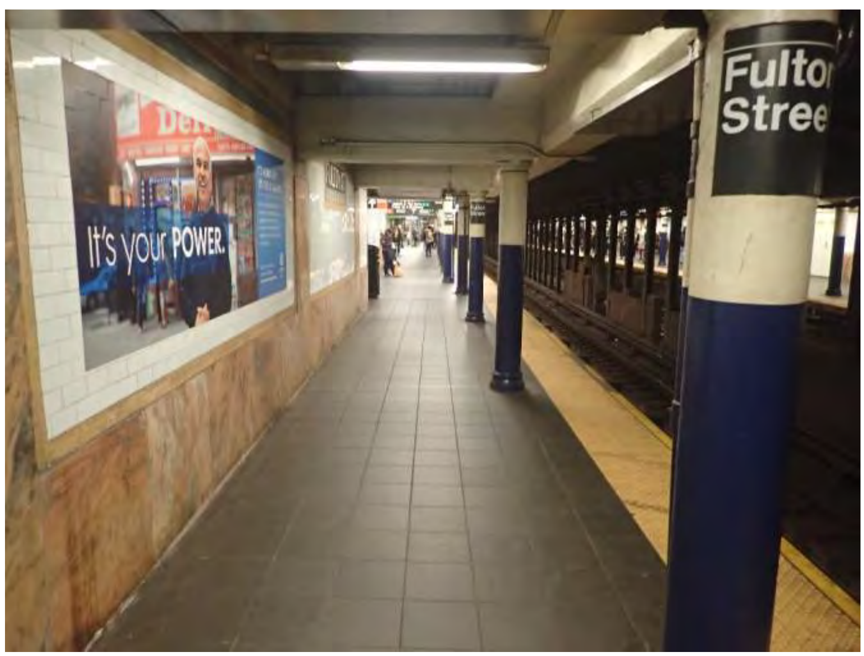

Figure 3 *– Typical platform view*
Fulton Street Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:
Existing lighting: Throughout both platforms there are linear florescent fixtures mounted both parallel and perpendicular to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:
This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 & Table 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal Service. SS-3)

Station Name	Fulton Street
Peak Demand Load from ConEd Report, (KW)	231.4
Apparent Power (kVA)	289.2
Station Peak Demand Load, Max Current, (A)	803.3
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	961
Station Service Power Capacity, (Main SB or SG Rating), (A)	9222.22
Service Spare Capacity, (A)	8261
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey. 1 line diagram provided does not match field survey. Station has total (3) services (SS-1,SS-2 & SS-3) @ 480 Volt and has (3) associated meters. The 480 V data is converted to 208 V units. This analysis is for **Normal service** meter reading provided for Service 'SS-3' @ Rm# T5-09.

***Table 1**. Normal Service Power Capacity Analysis*

Station
Power Capacity Analysis (Normal+ Reserve Service)

Station Name	Fulton Street
Peak Demand Load from ConEd Report, (KW)	1182.2
Apparent Power (kVA)	1477.8
Station Peak Demand Load, Max Current, (A)	4945.8
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	5104
Station Service Power Capacity, (Main SB or SG Rating), (A)	18444.44
Service Spare Capacity, (A)	13341
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey. 1-line diagram provided does not match field survey. Station has total (3) services (SS-1,SS-2 & SS-3) @ 480 Volt and has (3) associated meters.The 480 V data is converted to 208 V units. This analysis is for combined **Normal & Reserve service** meter reading provided for Service 'SS-1' @ Rm# T5-09 and Service 'SS-2' @ Rm# T5-08.

Table 2*. Norma l Reserve Service Power Capacity Analysis*

Historic Restrictions:
This station is a designated historical place. As such, any capital improvement will be subject to review by the State Historic Preservation Office.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.5M to install APGs and $34.6M to install PSDs (See Appendix E)

1.52 – MR 413 | Wall Street

***Summary:** Wall Street Station is not feasible for both APGs and PSDs as the columns which are located 20" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Wall Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 20" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

***Figure 1 –** Column 20" from the edge*
Wall Street Station

1.53 – MR 414 | Bowling Green

Summary: *Bowling Green Station is feasible for both APGs and PSDs. Two structural columns will need to be relocated due to their proximity to the platform edge. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Bowling Green Station is a below-grade station with one side platform & one center / island platform that has only one active platform edge (**see Figure 1**). The platform structures are cast-in-place concrete. Columns are located throughout the platforms along the platform edges. Column faces measure approximately 2'-2" from the platform edge. Two columns on the southbound platform measure 17" from the platform edge. The platform widths range approximately from 14-0" – 24'-0" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located on the northbound platform of the station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are approximately tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

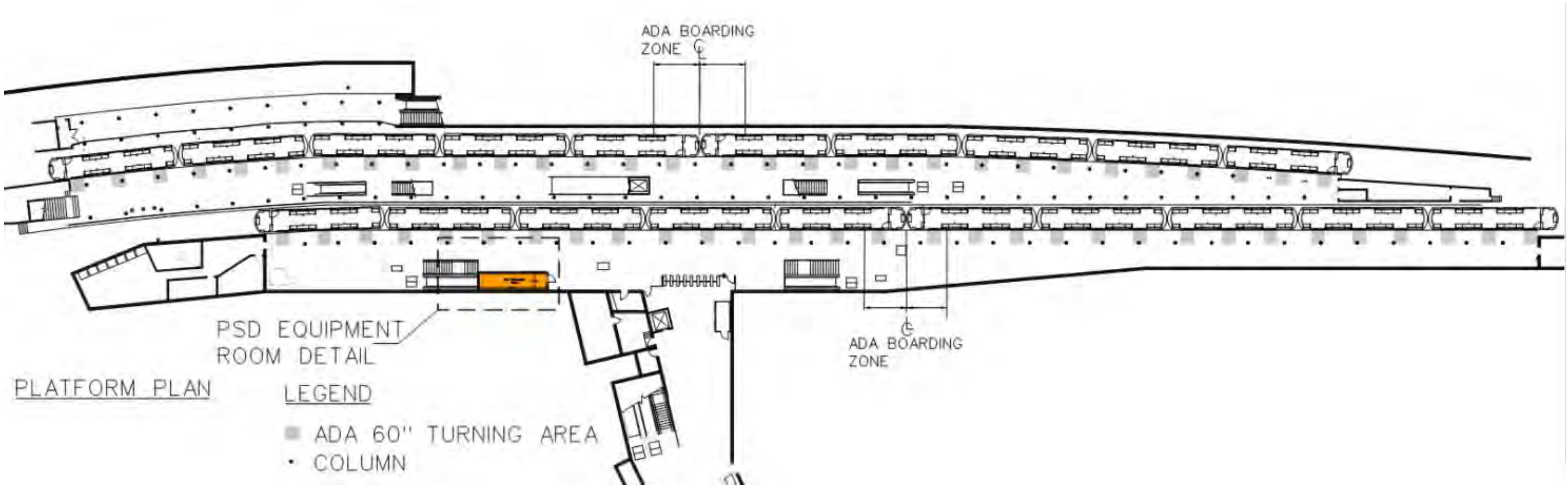

***Figure 1** – Overall Station Plan*
Bowling Green Station

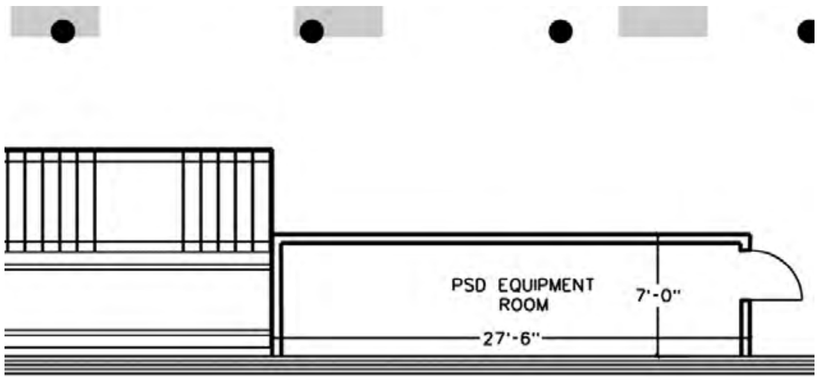

***Figure 2** – PSD Equipment Room 1 Detail*
Bowling Green Station

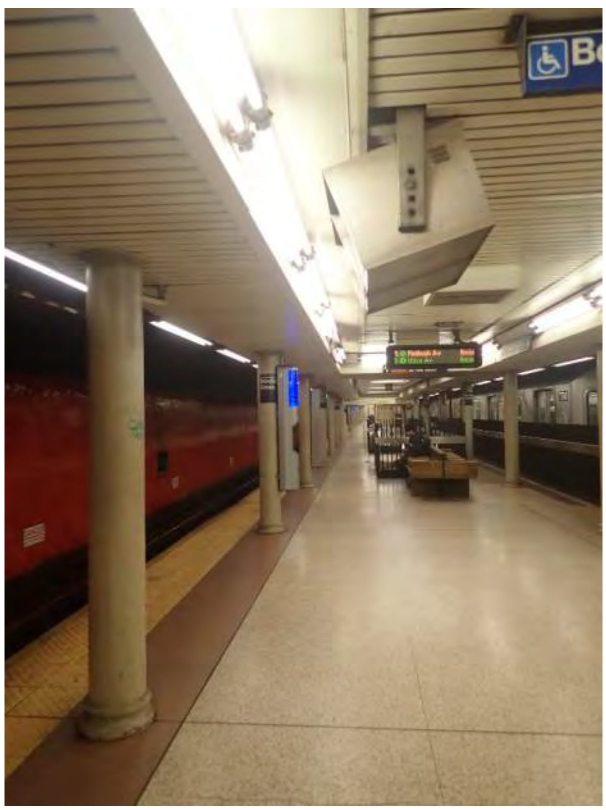

***Figure 3** – Typical platform view*
Bowling Green Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 & Table 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal Service)

Station Name	Bowling Green Bway
Peak Demand Load from ConEd Report, (kW)	102.4
Apparent Power (kVA)	128.0
Station Peak Demand Load, Max Current, (A)	355.6
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	514
Station Service Power Capacity, (Main SB or SG Rating), (A)	1600
Service Spare Capacity, (A)	1086
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on 1 line diagram drawing from field, having 1600 A Service switch. Station has (2) separate meter readings for each Normal & Reserve service. This analysis is for **Normal service**.Note that Power Demand Data provided is interchanged between Normal & Reserve meter.

Table 1. Normal Service Power Capacity Analysis

Station
Power Capacity Analysis (Reserve Service)

Station Name	Bowling Green Bway
Peak Demand Load from ConEd Report, (kW)	163.2
Apparent Power (kVA)	204.0
Station Peak Demand Load, Max Current, (A)	566.7
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	725
Station Service Power Capacity, (Main SB or SG Rating), (A)	1600
Service Spare Capacity, (A)	875
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on 1 line diagram drawing from field, having 1600 A Service switch. Station has (2) separate meter readings for each Normal & Reserve service. This analysis is for **Reserve service**.Note that Power Demand Data provided is interchanged between Normal & Reserve meter.

Table 2. Reserve Service Power Capacity Analysis

Historic Restrictions:
This station is a designated historical place for its original entrance & control house. As such, any capital improvement will be subject to review by the State Historic Preservation Office.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.3M to install APGs and $33.8M to install PSDs (See Appendix E)

1.54 – MR 415 | Borough Hall Station

Summary: *Borough Hall Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Borough Hall Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 16" from the edge*
Borough Hall Station

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*
>
> *a. Column location in relation to the platform edge*
> *b. Platform edge clearance adjacent to stairs and other impediments*
> *c. Impacts to ADA path of travel and boarding areas*
> *d. Conflicts of PSD/APG/RPSDs with Signals cables*
> *e. Sufficient platform width*
> *f. Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*
>
> *a. Structural capacity of platforms to accept PSD/APG/RPSDs*
> *b. Feasibility & location for PSD/APG/RPSDs equipment room*
> *c. Confirmation of adequate power for PSD/APG/RPSDs*
> *d. Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> *e. Determination of communications requirements, availability and cost*
> *f. Determination of gap detection and entrapment avoidance technology requirements*
> *g. Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
    - Double the amount of motors as PSDs (each motor operating a single leaf).
    - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
    - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
    - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

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If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

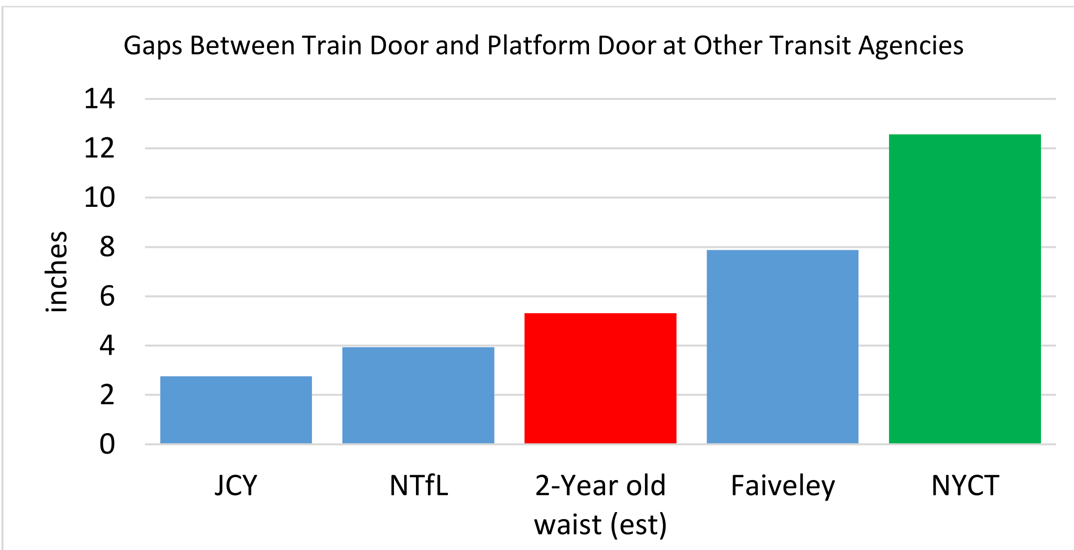


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

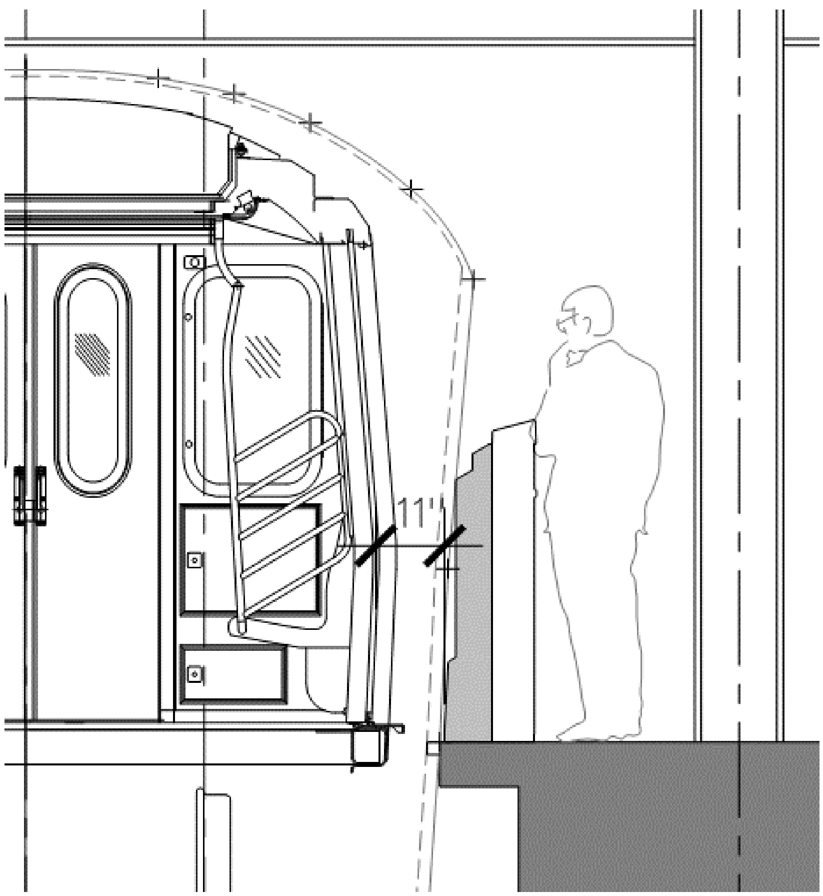


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber "bumpers" on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6" into the line equipment envelope. This would leave a 5" gap between the platform and car doors allowing approximately 2" of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5" by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor's window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor's window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **<u>bold/underline</u>**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	PSD System 1	PSD System 2	PSD System 3
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Station Capacity Analysis	**3rd Ave.**	**6th Ave.**	**14 St / Union Square**	**1st Ave.**
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are “existing” as defined by code. All the rolling stock is also to be considered “existing” under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60” radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36” of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

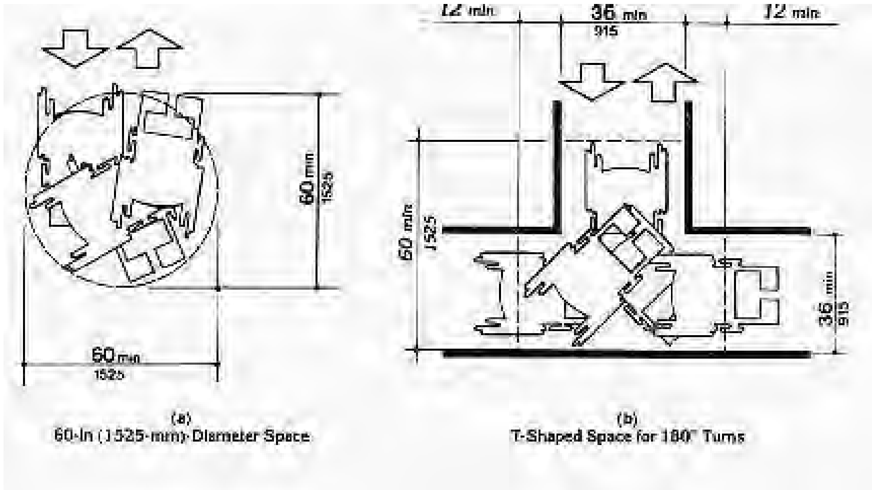
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

> *Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.*

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

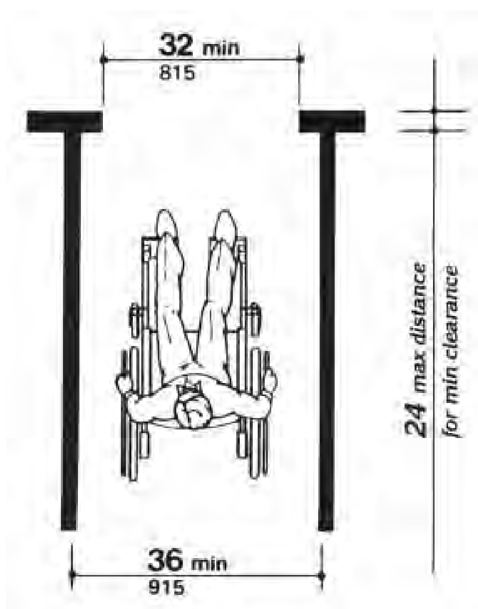


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

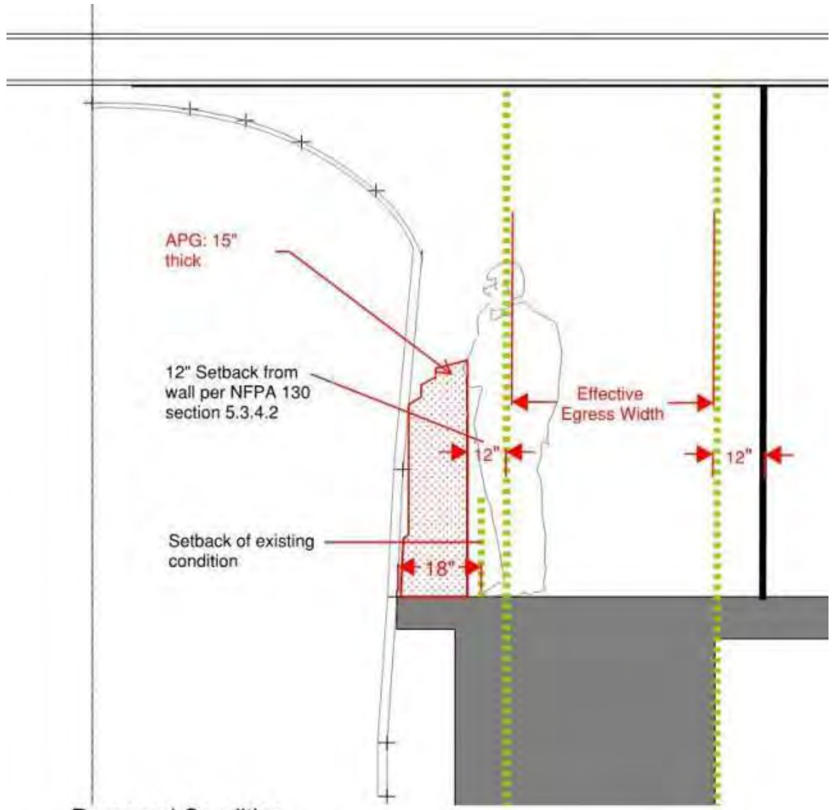
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15" of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

Table of Contents

Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

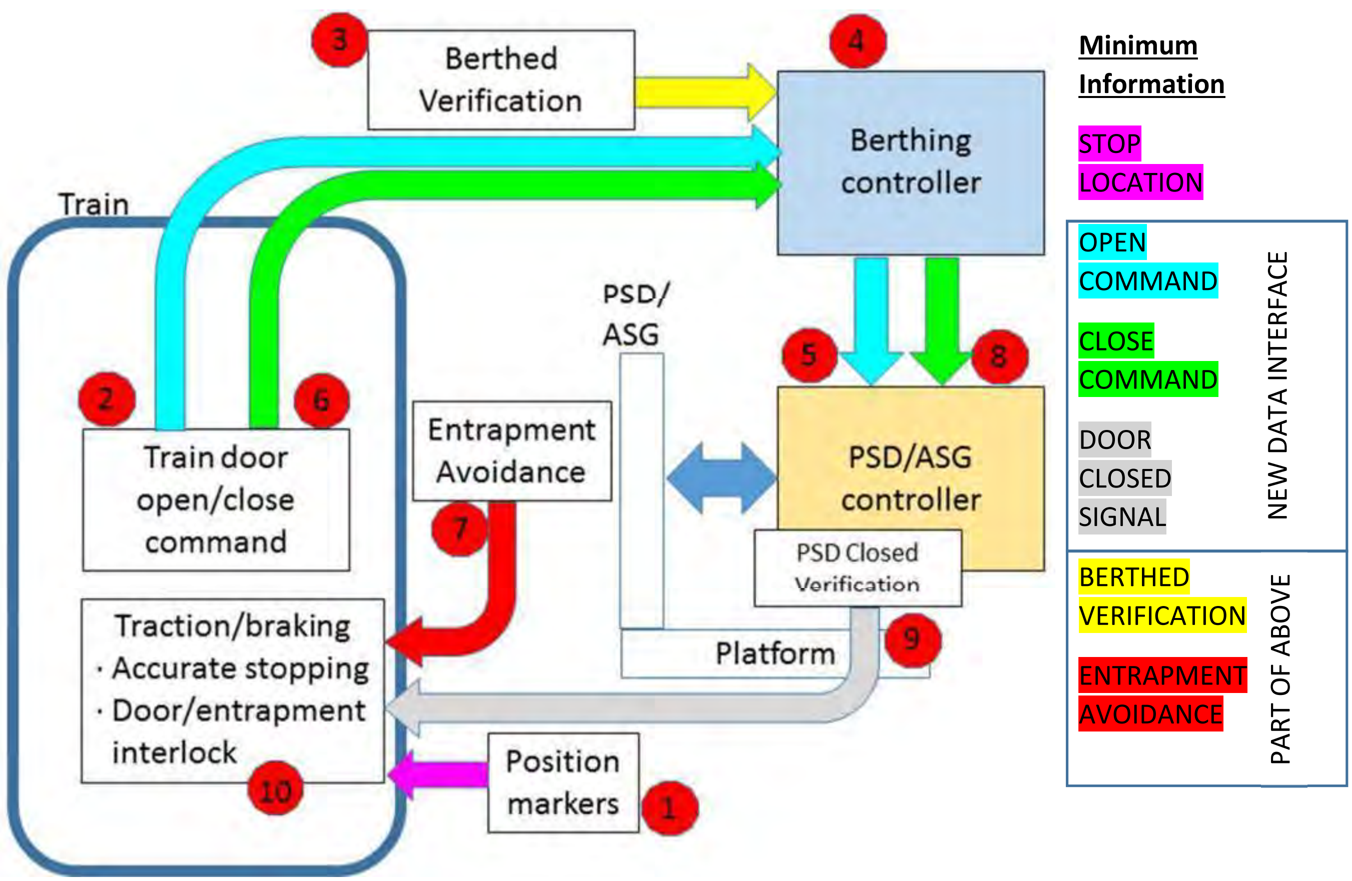
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

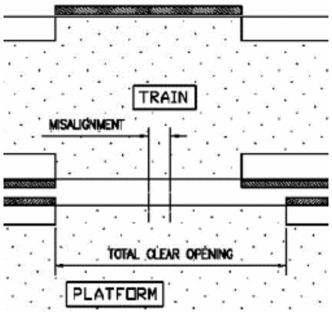
C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5" clear opening, a design for NY should meet the ADA Accessibility Guideline of 36".

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a 'distance totem' which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy's COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

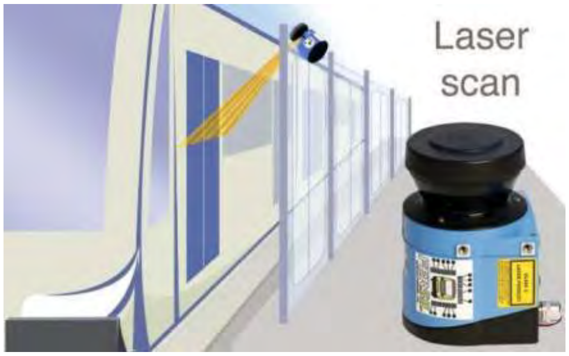
The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically

If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.



For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4’-0”). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

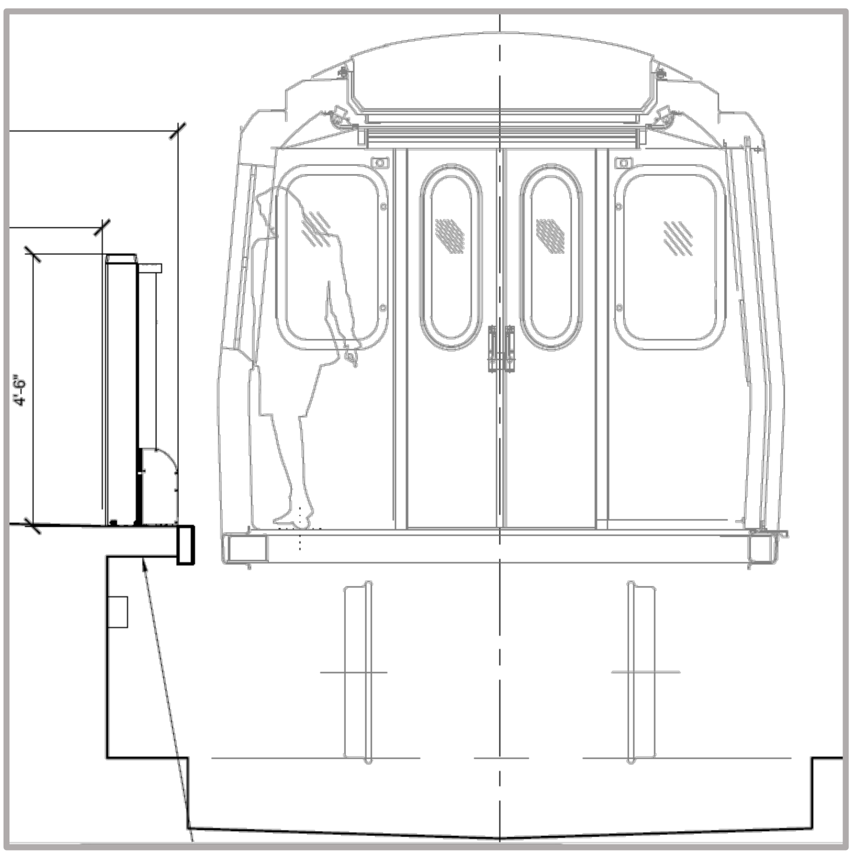


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

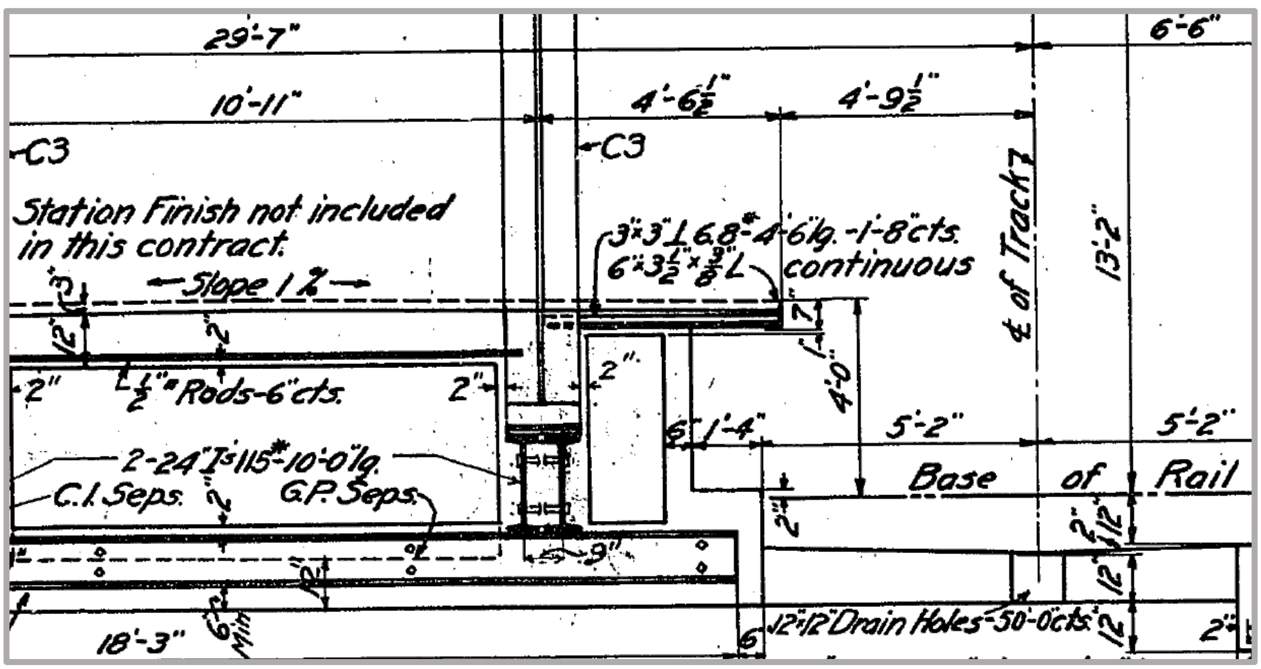


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6” thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1’-2” long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

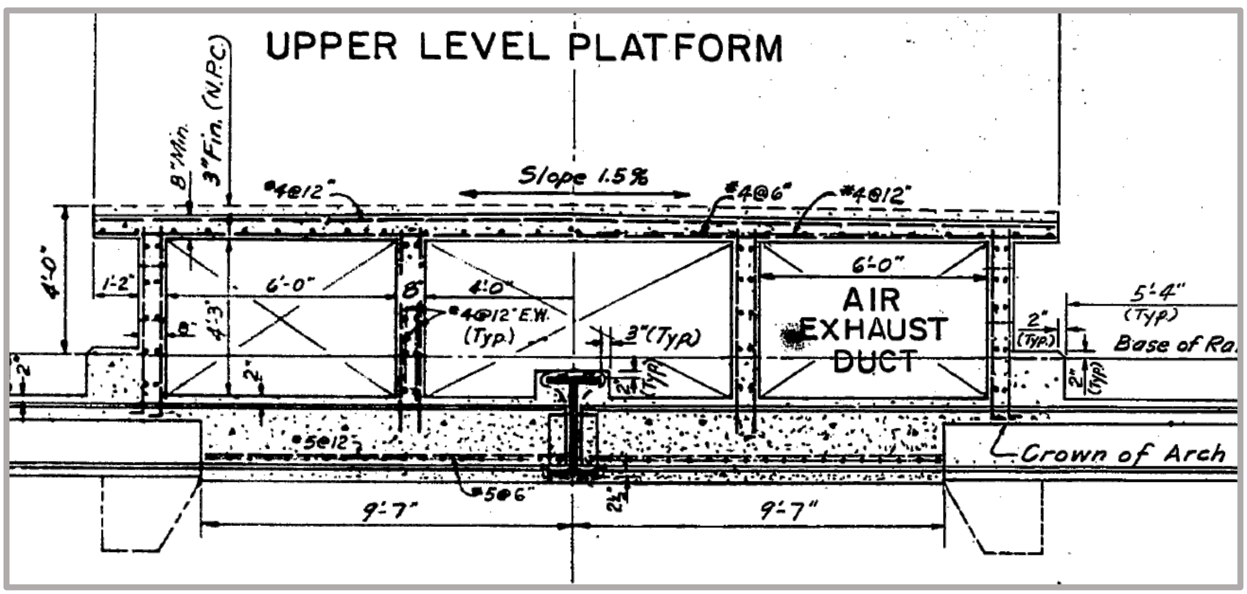


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; “E”, “J”, and “Z” trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

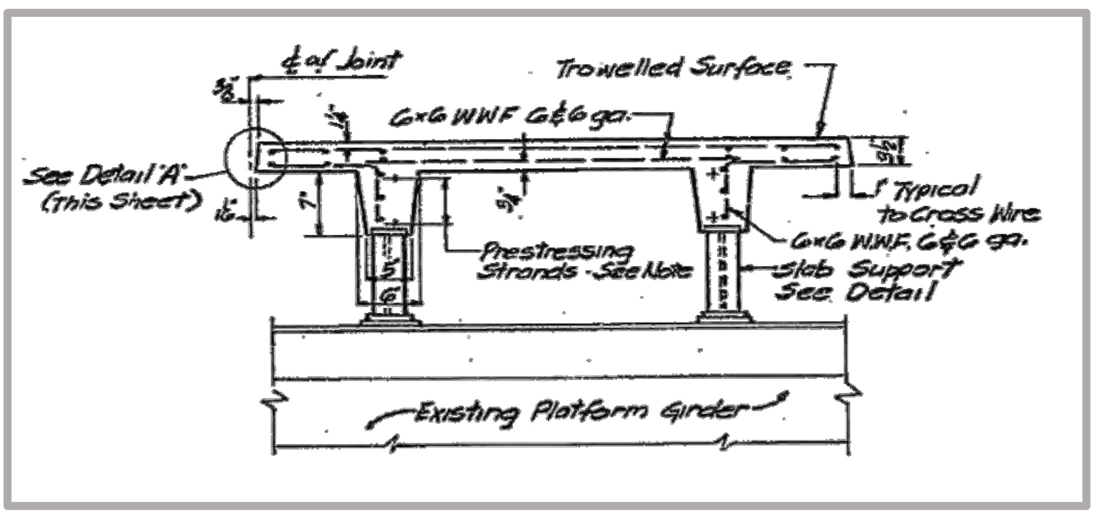


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

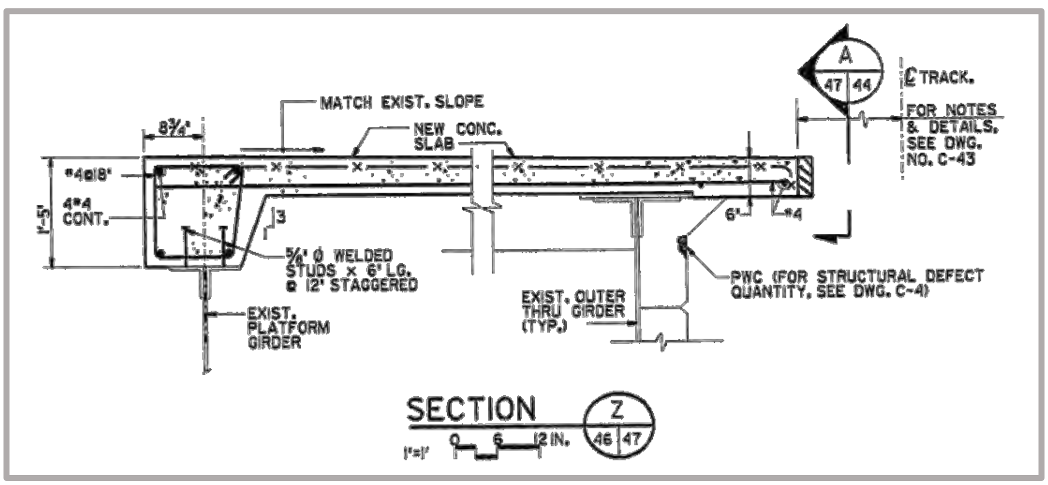


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2'-9"), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

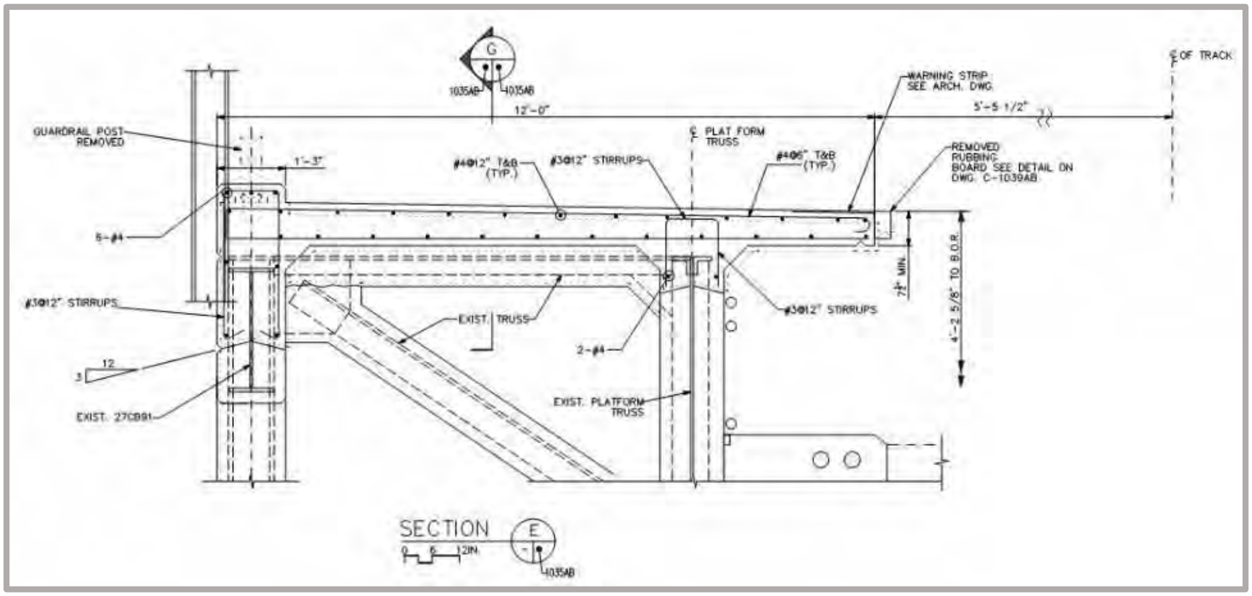


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3" thick structural slab with an approximately 3" thick topping slab. If the topping slab is fully removed, a 6" thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6" thick slab will be sufficient for a cantilever length of up to approximately 3'-0", greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6" structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6" minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

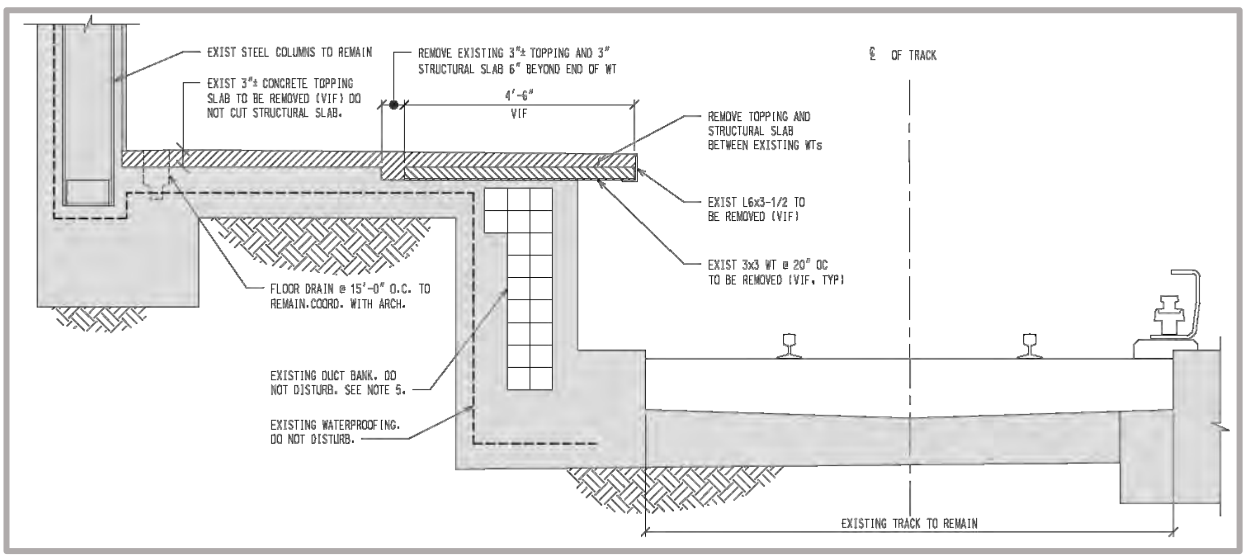


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

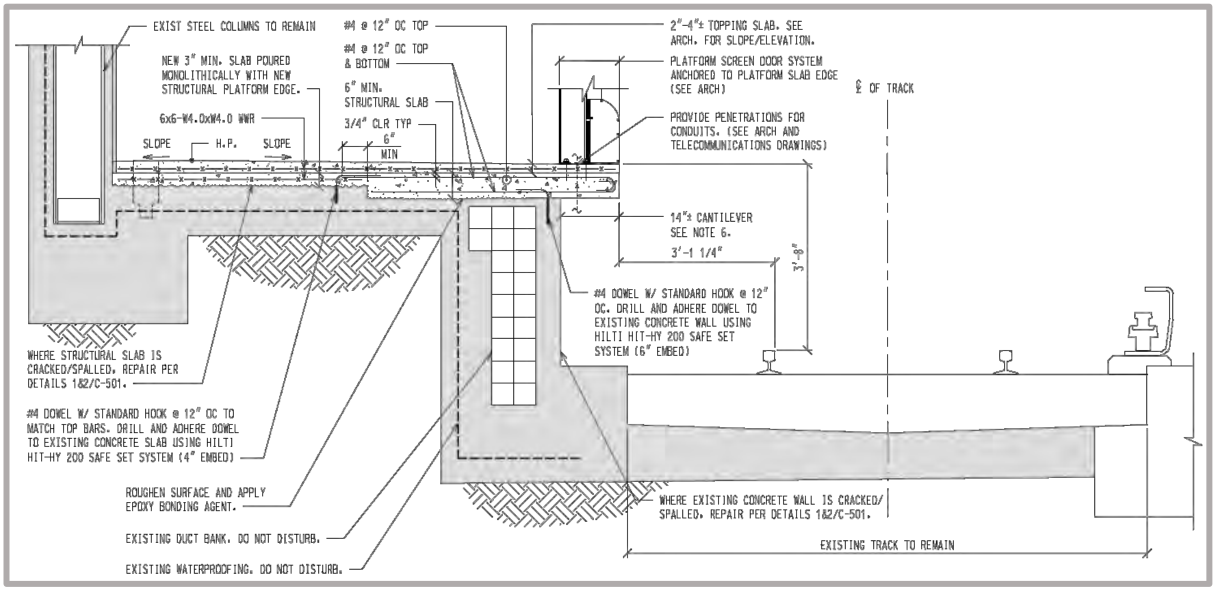


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

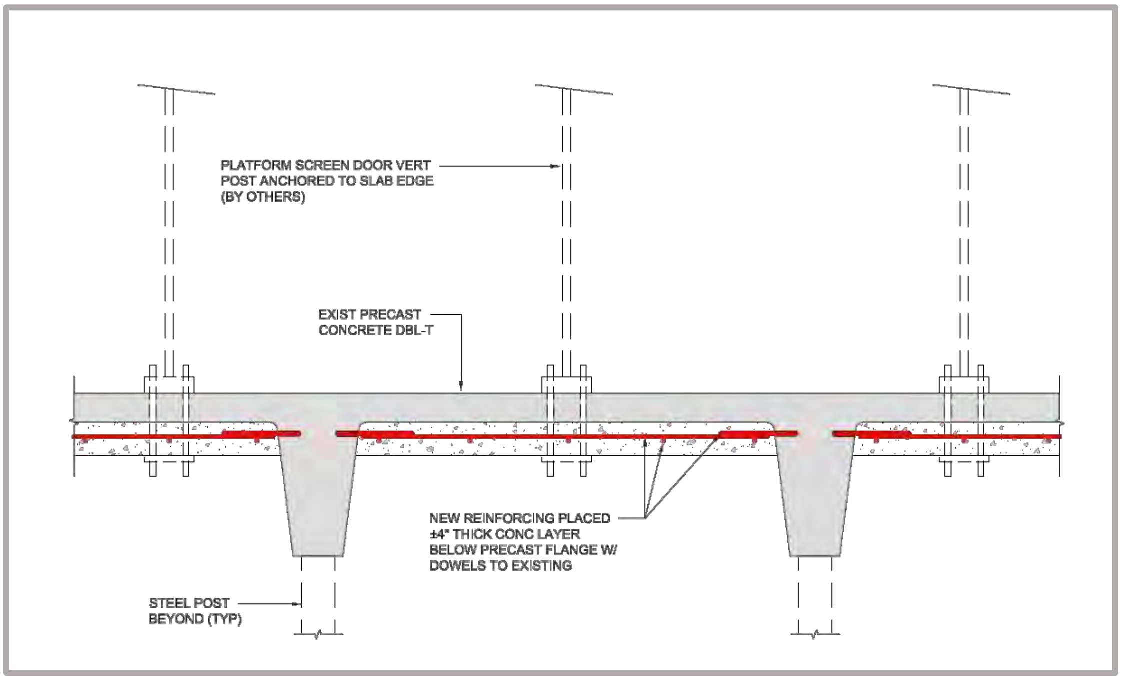


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5' – 11" of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

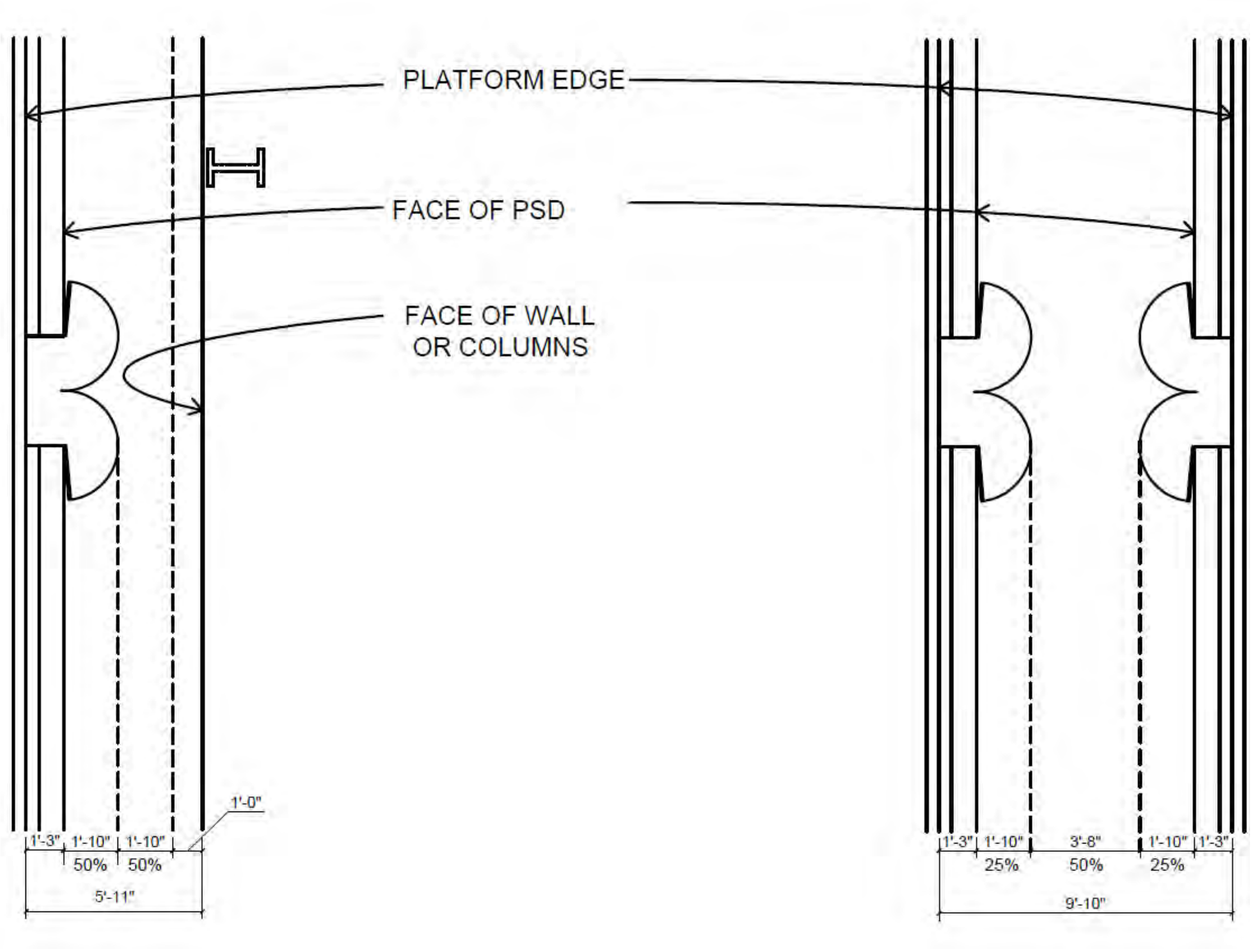


FIGURE 1: SIDE PLATFORM

FIGURE 2: CENTER PLATFORM

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

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MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	9	$ 63,500 per month [Year 01]	$ 571,500		
		12	$ 83,590 per month [Year 02]	$ 1,003,080		
		12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment.	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
		12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663		

ITEM NO.	DESCRIPTION		RATE	
7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *	
		Year 3	$ 257 per hour *	
	Optional :	Year 4	$ 268 per hour *	
	Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

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ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations
ESTIMATE DATE:	March 25, 2019

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VJ ASSOCIATES
ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

MTA/NYCT

March 25, 2019

BASIS OF ESTIMATE

1.0 *Description of typical APG / PSD installation:*

1.1 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.2 *APGs / PSDs will provide 29 emergency egress doors with push bars per platform*
1.3 *Each platform edge will have 40 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 *Assumptions:*

2.1 It is assumed that each train has 10 cars on this line
2.2 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.3 In respect of the PSD option, only platforms that have not been upgraded in the recent past will require platform edge replacement.
2.4 There are no special security requirements made necessary by installation of the APG system
2.5 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.6 This estimate does not provide for the replacement of Platform Edge Lighting
2.7 Premium cost for night time work is considered 50% of total labor cost

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VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

MTA/NYCT

March 25, 2019

BASIS OF ESTIMATE

3.0 ***Exclusions - Costs not included in the estimate:***

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems

3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length

3.4 Costs associated with NYCT State Of Good Repair improvements to the station

3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.

3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs

3.7 Escalation Cost is not included; Anticipate at 5% per annum.

3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.

3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium

3.10 NYCT project cost is not included

3.11 GO and flagging cost is not included

3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or "soft" costs:***

4.1 Design and Construction Contingency

4.2 Contractor O & P

4.3 Insurance

4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 Given the limited time available, no drawings were developed to support this estimate.

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MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

March 25, 2019

ORDER OF MAGNITUDE COSTS			MRN 339	MRN 395	MRN 401	MRN 412	MRN 414
	DESCRIPTION		BERGEN STREET	103RD STREET	51ST STREET	FULTON STREET	BOWLING GREEN
1	AUTOMATIC PLATFORM GATES (APG'S)		$14,242,796	$14,643,536	$14,495,691	$14,569,859	$14,473,186
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$14,242,796	$14,643,536	$14,495,691	$14,569,859	$14,473,186
4	GENERAL REQUIREMENTS	15.00%	$2,136,419	$2,196,530	$2,174,354	$2,185,479	$2,170,978
	SUB-TOTAL:		$16,379,215	$16,840,067	$16,670,044	$16,755,338	$16,644,163
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,094,804	$4,210,017	$4,167,511	$4,188,835	$4,161,041
	SUB-TOTAL:		$20,474,019	$21,050,083	$20,837,555	$20,944,173	$20,805,204
6	OVERHEAD & PROFIT	15.00%	$3,071,103	$3,157,513	$3,125,633	$3,141,626	$3,120,781
	SUB-TOTAL:		$23,545,122	$24,207,596	$23,963,189	$24,085,799	$23,925,985
7	BONDS & INSURANCE	3.75%	$882,942	$907,785	$898,620	$903,217	$897,224
	SUB-TOTAL:		$24,428,064	$25,115,381	$24,861,808	$24,989,016	$24,823,209
	SUBTOTAL CONSTRUCTION COST W/O ACM		**$24,428,064**	**$25,115,381**	**$24,861,808**	**$24,989,016**	**$24,823,209**
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		**$24,428,064**	**$25,115,381**	**$24,861,808**	**$24,989,016**	**$24,823,209**
10	DESIGN CONSULTANT FEES	10.00%	$2,442,806	$2,511,538	$2,486,181	$2,498,902	$2,482,321
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		**$26,870,870**	**$27,626,919**	**$27,347,989**	**$27,487,918**	**$27,305,530**
	ADD ALTERNATIVES						
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		$3,383,096	$3,645,891	$3,744,255	$3,777,105	$3,429,795
	Add for Markups (as above)	88.66%	2,999,551	3,232,552	3,319,765	3,348,890	3,040,955
	SUB-TOTAL PSD ALTERNATIVE		**$6,382,646**	**$6,878,443**	**$7,064,020**	**$7,125,995**	**$6,470,750**
	TOTAL PROJECT COST (PSD OPTION)		**$33,253,516**	**$34,505,362**	**$34,412,009**	**$34,613,912**	**$33,776,281**

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : BERGEN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	512	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	512	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,024**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,024	LF	7	7,168
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,120	SF	12	61,440
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	103	CY	2,500	257,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,026	EA	25	25,650
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,026	EA	25	25,650
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,024	LF	95	97,280
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,024	LF	15	15,360
26	Remove existing platform tiles	1,024	LF	12	12,288
27	Sawcut existing topping concrete at perimeter of removal area	1,024	LF	5	5,120
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,144	SF	8	49,152
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-0" wide strip	560	SF	8	4,480
30	New Work				
31	New concrete topping to match existing	1,024	SF	15	15,360

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : BERGEN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	560	SF	15	8,400
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,133	SF	750	1,599,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	192,045	192,045
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : BERGEN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,024	LF	60	61,440
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	200	LF	60	12,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : BERGEN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,286,799	3,286,799
112					
113	TOTAL PSD WORK:				$ 14,242,796
115					
116	**ADD ALTERNATIVE**				
117					
118	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
119					
120	**ADD**				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,526	SF	750	3,394,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	353,777	353,777
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	68,200
129	L6x6x1/2 continuous angle	8	TONS	17,500	131,891
130	Drilling and bolting - 4 bolts at each connection	410	EA	216	88,474
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : BERGEN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,133)	SF	750	(1,599,750)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	192,045	(192,045)
152	Platform Edge Reconstruction work	(1)	LS	485,440	(485,440)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,024)	LF	30	(30,720)
155					
156	Allow loss of production to work at night say 50%	1	LS	780,714	780,714
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				**$ 3,383,096**

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STATION : 103RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	550	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	550	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,100**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,100	LF	7	7,700
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,500	SF	12	66,000
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	111	CY	2,500	277,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,102	EA	25	27,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,102	EA	25	27,550
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,100	LF	95	104,500
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,100	LF	15	16,500
26	Remove existing platform tiles	1,100	LF	12	13,200
27	Sawcut existing topping concrete at perimeter of removal area	1,100	LF	5	5,500
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,600	SF	8	52,800
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10'-0" wide strip	320	SF	8	2,560
30	New Work				
31	New concrete topping to match existing	1,100	SF	15	16,500

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : 103RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	320	SF	15	4,800
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,475	SF	750	1,856,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	207,435	207,435
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : 103RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,100	LF	60	66,000
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : 103RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,379,278	3,379,278
112					
113	TOTAL PSD WORK:				$ 14,643,536
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,134	SF	750	3,850,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	381,137	381,137
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	73,165
129	L6x6x1/2 continuous angle	8	TONS	17,500	141,680
130	Drilling and bolting - 4 bolts at each connection	440	EA	216	95,040
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : 103RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,475)	SF	750	(1,856,250)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	207,435	(207,435)
152	Platform Edge Reconstruction work	(1)	LS	513,800	(513,800)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,100)	LF	30	(33,000)
155					
156	Allow loss of production to work at night say 50%	1	LS	841,359	841,359
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 3,645,891

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : 51ST STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	534	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	534	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,067**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,067	LF	7	7,471
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,337	SF	12	64,040
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	108	CY	2,500	270,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,069	EA	25	26,734
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,069	EA	25	26,734
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,067	LF	95	101,397
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,067	LF	15	16,010
26	Remove existing platform tiles	1,067	LF	12	12,808
27	Sawcut existing topping concrete at perimeter of removal area	1,067	LF	5	5,337
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,404	SF	8	51,232
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10' wide strip	520	SF	8	4,160
30	New Work				
31	New concrete topping to match existing	1,067	SF	15	16,010

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : 51ST STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	520	SF	15	7,800
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,328	SF	750	1,746,023
61	Spare Parts - Approx. 10% of Material Cost	1	LS	200,821	200,821
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : 51ST STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,067	LF	60	64,040
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	250	LF	60	15,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	300	LF	60	18,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : 51ST STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,345,159	3,345,159
112					
113	TOTAL PSD WORK:				$ 14,495,691
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,872	SF	750	3,654,315
126	Spare Parts - Approx. 10% of Material Cost	1	LS	369,379	369,379
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	71,031
129	L6x6x1/2 continuous angle	8	TONS	17,500	137,473
130	Drilling and bolting - 4 bolts at each connection	427	EA	216	92,218
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300’ length is associated with one signal light]				
136	Disconnects	40	HRS	162	6,480
137	Remove signal cables	300	LF	40	12,000
138	Remove conduit; Assuming 1”	300	LF	55	16,500
139	Install conduit in new position	300	LF	110	33,000
140	Install replacement cable; assumed single cable #12	300	LF	125	37,500
141	Re-commission / testing as required	1	EA	12,500	12,500
142	Engineering / Shop Drawings / Etc.	1	EA	7,500	7,500
143	Premium Time	785	HRS	49	38,151
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : 51ST STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,328)	SF	750	(1,746,023)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	200,821	(200,821)
152	Platform Edge Reconstruction work	(1)	LS	502,707	(502,707)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,067)	LF	30	(32,020)
155					
156	Allow loss of production to work at night say 50%	1	LS	864,059	864,059
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 3,744,255

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : FULTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	538	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	538	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,077**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,077	LF	7	7,538
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,384	SF	12	64,610
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	109	CY	2,500	272,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,079	EA	25	26,971
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,079	EA	25	26,971
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,077	LF	95	102,300
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,077	LF	15	16,153
26	Remove existing platform tiles	1,077	LF	12	12,922
27	Sawcut existing topping concrete at perimeter of removal area	1,077	LF	5	5,384
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,461	SF	8	51,688
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10' wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,077	SF	15	16,153

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : FULTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,371	SF	750	1,778,085
61	Spare Parts - Approx. 10% of Material Cost	1	LS	202,745	202,745
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : FULTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,077	LF	60	64,610
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	400	LF	60	24,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	450	LF	60	27,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : FULTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,362,275	3,362,275
112					
113	TOTAL PSD WORK:				$ 14,569,859
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,948	SF	750	3,711,315
126	Spare Parts - Approx. 10% of Material Cost	1	LS	372,799	372,799
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	71,652
129	L6x6x1/2 continuous angle	8	TONS	17,500	138,697
130	Drilling and bolting - 4 bolts at each connection	431	EA	216	93,039
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	40	HRS	162	6,480
137	Remove signal cables	300	LF	40	12,000
138	Remove conduit; Assuming 1"	300	LF	55	16,500
139	Install conduit in new position	300	LF	110	33,000
140	Install replacement cable; assumed single cable #12	300	LF	125	37,500
141	Re-commission / testing as required	1	EA	12,500	12,500
142	Engineering / Shop Drawings / Etc.	1	EA	7,500	7,500
143	Premium Time	785	HRS	49	38,151
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : FULTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,371)	SF	750	(1,778,085)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	202,745	(202,745)
152	Platform Edge Reconstruction work	(1)	LS	506,252	(506,252)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,077)	LF	30	(32,305)
155					
156	Allow loss of production to work at night say 50%	1	LS	871,640	871,640
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				**$ 3,777,105**

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : BOWLING GREEN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	522	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	516	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,038**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,038	LF	7	7,266
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,190	SF	12	62,280
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	105	CY	2,500	262,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,040	EA	25	26,000
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,040	EA	25	26,000
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,038	LF	95	98,610
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,038	LF	15	15,570
26	Remove existing platform tiles	1,038	LF	12	12,456
27	Sawcut existing topping concrete at perimeter of removal area	1,038	LF	5	5,190
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,228	SF	8	49,824
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10' wide strip	560	SF	8	4,480
30	New Work				
31	New concrete topping to match existing	1,038	SF	15	15,570

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : BOWLING GREEN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	560	SF	15	8,400
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Platform column restructuring**				
37	Demolition				
38	Install, maintain and remove temporary support	2	LS	15,000	30,000
39	Breakout existing platform slab for new column	2	LS	5,000	10,000
40	New Work				
41	Excavate for foundation for new column	2	EA	1,500	3,000
42	Foundation for new column	2	EA	5,000	10,000
43	New structural steel column	2	EA	20,000	40,000
44	Extend and repair beams above	2	LS	5,000	10,000
45	Grillage	2	EA	10,000	20,000
46					
47	**Equipment Room [7'-0" x 27'-6"]**				
48	Build off existing platform slab		Note		
49	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
50	CMU Wall for equipment room	415	SF	45	18,675
51	Vertical connections with existing structure	20	LF	25	500
52	Roof for equipment room	193	SF	30	5,775
53	Fire rated door including frame & hardware	1	EA	2,500	2,500
54	Exterior wall finish				
55	Ceramic Tiling to match existing	415	SF	40	16,600
56	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
57	Concrete cove to match existing	42	LF	20	830
58	Interior Wall Finish - Paint	690	SF	5	3,450
59	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
60	Allow for 4" thick concrete pads for equipment	48	SF	20	963
61	Allowance for Mechanical Scope	1	LS	40,000	40,000
62	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
63	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
64	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
65					
66	**Automatic Platform Gates [APGs] - 4'-6" High**				
67	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
68	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
69	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
70	Platform End Gates (PEGs)	4	EA	13,000	52,000
71	Fixed Panels including framing and support; 4'-6" High	2,196	SF	750	1,647,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : BOWLING GREEN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
72	Spare Parts - Approx. 10% of Material Cost	1	LS	194,880	194,880
73	Testing and commissioning	800	HRS	160	127,944
74	Product Warranty	1	LS	1,000,000	1,000,000
75	Allowance for Braille Signage	60	EA	2,500	150,000
76					
77	**Electrical**				
78	Electrical Upgrades				
79	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
80	Power and Lighting				
81	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
82	Allow for conduit / cable runs for power and communications under platform edge	1,038	LF	60	62,280
83	PSD Connections	1	LS	75,000	75,000
84	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
85	Power to PSD Rooms from EDR [Conduit & Cable]	100	LF	60	6,000
86	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
87	No allowance for new lighting as if APG's are used		Note		EXCL.
88	Grounding				
89	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
90	MISC				
91	Testing and commissioning	1	EA	30,000	30,000
92	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
93					
94	**Communications**				
95	FA System				
96	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
97	CCTV coverage				
98	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
99	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
100	Berthing Technology Sensors				
101	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
102	Train Door Detection System				
103	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
104	Entrapment concerns				
105	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
106	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
107	Engineering and Testing	1,000	Hrs	160	159,930

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : BOWLING GREEN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
108	Centralized monitoring/control				
109	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
110	MISC				
111	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
112	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
113	Site Survey and Inspections	1	LS	100,000	100,000
114	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
115	Furnish Test Equipment allowance	1	LS	500,000	500,000
116	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
117					
118	Training				
119	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
120					
121	Out of hours Work				
122	Allow loss of production to work at night say 50%	1	LS	3,339,966	3,339,966
123					
124	TOTAL PSD WORK:				$ 14,473,186
126					
127	ADD ALTERNATIVE				
128					
129	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
130					
131	ADD				
132	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
133	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
134	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
135	Platform End Gates (PEGs)	4	EA	18,000	72,000
136	Fixed Panels including framing and support; Assuming 8'-0" high	4,638	SF	750	3,478,275
137	Spare Parts - Approx. 10% of Material Cost	1	LS	358,817	358,817
138	Structual framing / bracing				
139	HSS4x4x1/2 hanger	4	TONS	17,500	69,115
140	L6x6x1/2 continuous angle	8	TONS	17,500	133,694
141	Drilling and bolting - 4 bolts at each connection	415	EA	216	89,683
142	Platform Edge Repair				
143	Remove concrete platform edge				Previously done
144	Platform edge repair				Previously done

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-4 Line Stations

25-Mar-19

STATION : BOWLING GREEN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
146	Signal Work [Each 300' length is associated with one signal light]				
147	Disconnects				Not Applicable
148	Remove signal cables				Not Applicable
149	Remove conduit; Assuming 1"				Not Applicable
150	Install conduit in new position				Not Applicable
151	Install replacement cable; assumed single cable #12				Not Applicable
152	Re-commission / testing as required				Not Applicable
153	Engineering / Shop Drawings / Etc.				Not Applicable
154	Premium Time				Not Applicable
155					
156	OMIT				
157	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
158	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
159	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
160	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
161	Fixed Panels including framing and support; 4'-6" High	(2,196)	SF	750	(1,647,000)
162	Spare Parts - Approx. 10% of Material Cost	(1)	LS	194,880	(194,880)
163	Platform Edge Reconstruction work	(1)	LS	491,980	(491,980)
164	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
165	Conduit running under Platform Edge	(1,038)	LF	30	(31,140)
166					
167	Allow loss of production to work at night say 50%	1	LS	791,491	791,491
168					
169	PREMIUM ASSOCIATED WITH PSD's				$ 3,429,795

New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR ‘’ SERVICE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

FINAL SUBMITTAL DATE: April 5, 2019 Rev. 8/13/2019

STV 100 Years

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Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. Our Tier 1 analysis found no instances of door misalignment between car classes for this line. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 55 newly evaluated stations, 49 have been found to be not suitable for the installation of PSDs.

[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to half-height barriers]

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues: the platform edge barriers are 15" wide. Where an existing object (wall, stair, and railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Under the following conditions, PSDs are declared infeasible:
    - Limit the ability of a wheelchair to turn within a 5'-0" circle
    - Limit path of travel to less than a 32" pinch width (defined as an obstruction that measures less than 2'-0" longitudinally, i.e. columns)
    - Limit path of travel to be less than a 36" corridor as defined by the edge of a staircase, railing or room
- Insufficient space for the PSD equipment room: the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow: due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements regarding the placement of these new barriers in an existing station environment.
- Structural considerations: existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.

- Columns at platform edge: at certain stations, the columns are positioned 16" to 24" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space.

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the previously proposed 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the PSD barriers and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is used for refuse removal at most of the 5-line stations. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the (off) loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in damage from these carts along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 11% of the '5' Line Stations. Total implementation cost would be $163.5M for APGs and $136.3M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; that estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of $931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 6 feasible stations, the aggregate annual maintenance cost would be $5.6M.

Summary Table

(11% Feasible 6/55)

MRN No.	*Station Names*	*Station Type*	*Platform Type*	*Feasibility*	*Issues/Reason for Failure*	*Cost APGs*	*Cost PSDs*
337	Nevins Street Flatbush	SUB	Island	No	Columns too close to edge	-	-
338	Atlantic Avenue Barclay	SUB	Island	No	Columns too close to edge	-	-
342	Franklin Avenue	SUB	Island	No	Columns too close to edge	-	-
343	Nostrand Ave Eastern	SUB	Side	No	No PSD Room Location	-	-
344	Kingston Avenue	SUB	Side	No	No PSD Room Location	-	-
345	Crown Heights Utica	SUB	Island	No	Columns too close to edge	-	-
346	Sutter Ave. Rutland Rd	ELV	Side	No	Precast Platform	-	-
353	President Street	SUB	Island	No	ADA Clearance	-	-
354	Sterling Street	SUB	Side	Yes	-	$26.8M	$33.4M
355	Winthrop Street	SUB	Side	No	ADA Clearance	-	-
356	Church Avenue	SUB	Side	No	No PSD Room Location	-	-
357	Beverly Rd	SUB	Side	No	Non-Compliant Egress Path	-	-
358	Newkirk Avenue	SUB	Side	No	Non-Compliant Egress Path	-	-
359	Flatbush Ave	SUB	Side	No	ADA Clearance	-	-
391	138th Street	SUB	Side	No	ADA Clearance	-	-
392	125th Street	SUB	Island	No	ADA clearance / cols. at edge	-	-
393	116th Street	SUB	Side	No	No PSD Room Location	-	-
394	110th Street	SUB	Side	No	No PSD Room Location	-	-
395	103rd Street	SUB	Side	Yes	-	$27.6M	$34.5M
396	96th Street	SUB	Side	No	Non-Compliant Egress Path	-	-
397	86th Street	SUB	Side	No	ADA Clearance	-	-
398	77th Street	SUB	Side	No	ADA Clearance	-	-
399	68th Street Hunter	SUB	Side	No	Non-Compliant Egress Path	-	-
400	59th Street	SUB	Side	No	ADA Clearance	-	-
402	Grand Ctrl 2nd St	SUB	Island	No	ADA Clearance	-	-
406	14th Street Union	SUB	Island	No	Gap Fillers	-	-
411	Bklyn Bridge City Hall	SUB	Island	No	ADA Clearance	-	-
412	Fulton Street Bway	SUB	Side	Yes	-	$27.5M	$34.6M
413	Wall Street	SUB	Side	No	Columns too close to edge	-	-
414	Bowling Green	SUB	Island	Yes	-	$27.3M	$33.8M
415	Borough Hall Court St.	SUB	Side	No	Columns too close to edge	-	-
417	238th Street Nereid	ELV	Side	No	Precast Platform	-	-
418	233rd St.	ELV	Side	No	Precast Platform	-	-
419	225th Street	ELV	Side	No	Precast Platform	-	-
420	219th Street	ELV	Side	No	Precast Platform	-	-
421	Gun Hill Road	ELV	Island	No	Precast Platform	-	-
422	Burke Avenue	ELV	Side	No	Precast Platform	-	-
423	Allerton Avenue	ELV	Side	No	Precast Platform	-	-
424	Pelham Parkway	ELV	Side	No	Precast Platform	-	-
425	Bronx Park East	ELV	Side	No	Precast Platform	-	-

Tier 2-3 Report on Feasibility of Platform Edge Barriers for '5' Line Stations

MRN No.	Station Names	Station Type	Platform Type	Feasibility	Issues/Reason for Failure	Cost APGs	Cost PSDs
426	East 180th Street Morris	ELV	Island	No	Precast Platform	-	-
427	West Farm Sq. / E.	ELV	Side	No	Precast Platform	-	-
428	174th Street	ELV	Side	No	Precast Platform	-	-
429	Freeman St.	ELV	Side	No	Precast Platform	-	-
430	Simpson Street	ELV	Side	No	Precast Platform	-	-
431	Intervale Avenue	ELV	Side	No	Precast Platform	-	-
432	Prospect Avenue	ELV	Side	No	Precast Platform	-	-
433	Jackson Avenue	ELV	Side	No	Precast Platform	-	-
434	3rd Avenue 149th	SUB	Side	No	Columns too close to edge	-	-
435	149th Street	SUB	Side	No	ADA Clearance	-	-
442	Eastchester / Dyre Ave.	EMB	Island	No	No PSD Room Location	-	-
443	Baychester Avenue	EMB	Side	Yes	-	$27.1M	
444	Gun Hill Road	EMB	Side	No	Non-Compliant Egress	-	-
445	Pelham Parkway	SUB	Island	No	Non-Compliant Egress	-	-
446	Morris Park	EMB	Side	Yes		$27.2M	-
					Total	$163.5M	$136.3M

1.0 Station Assessments

1.01 – MR 337 | Nevins Street Station

Summary: *Nevins Street Station is not feasible for both APGs and PSDs as the columns which are located 20" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description

Nevins Street Station is a below-grade station with two center / island platforms. The platform structures are cast-in-place concrete. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 20" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by these columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the structural columns pose cost prohibitive scenarios.

***Figure 1** – Columns at 20" from platform edge*
Nevins Street Station

1.02 – MR 338 | Atlantic Avenue Barclay Center Station

Summary: *Atlantic Avenue Barclay Ctr. Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Atlantic Avenue Barclay Ctr. is a below-grade station consisting of one center / island platform (the No. 2&3 trains utilize separate side platforms). This report concerns only the No. 4&5 train platform. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The column pictured in Figure 1 measures approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 16" from the edge*
Atlantic Avenue Barclay Ctr. Station

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1.03 – MR 342 | Franklin Avenue Botanic Garden Station

Summary: *Franklin Avenue Botanic Garden Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Franklin Avenue Station is a below-grade station consisting of two center / island platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The column pictured in Figure 1 measures approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 16" from the edge*
Franklin Avenue Station

1.04 – MR 343 | Nostrand Avenue / Eastern Pkwy

Summary: *Nostrand Avenue Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

Nostrand Avenue Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. Platform widths vary from 7'-10" to 11'-10". There is a single row of columns on each platform.

Due to the limited width of the existing platforms, there is no available space for the equipment room. Figure 2 below shows the minimum width required (12'-11") for construction of a PSD equipment room on a station platform. Figure 1, below, demonstrates the lack of available space within the main control area.

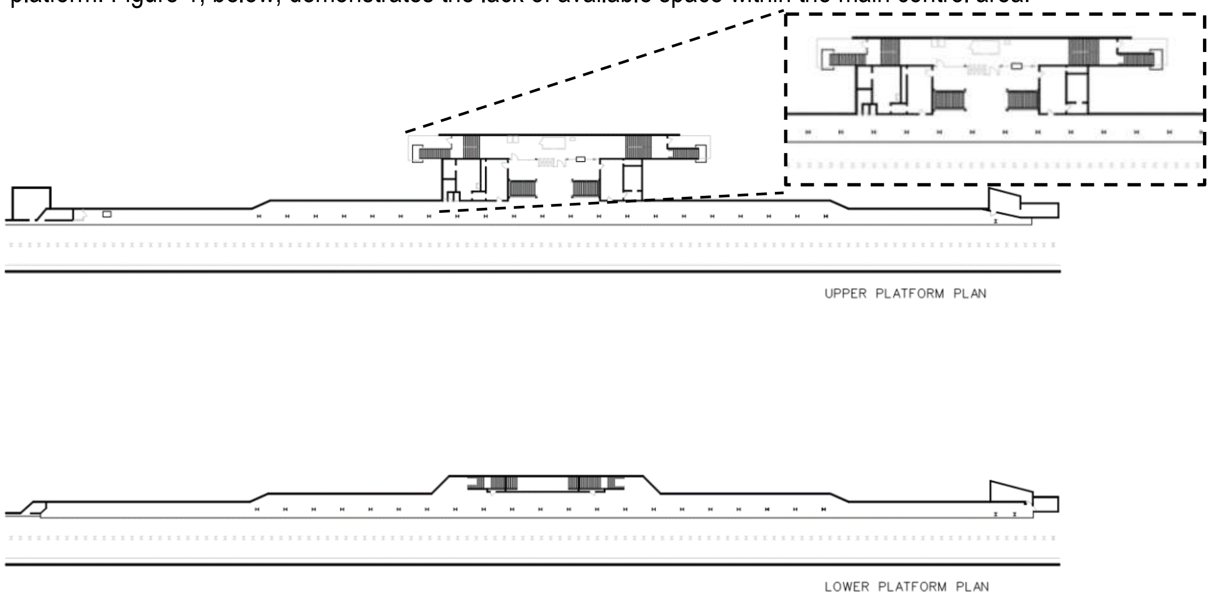

Figure 1 *– Congested/Narrow Station Plan*
Nostrand Avenue Eastern Pkwy

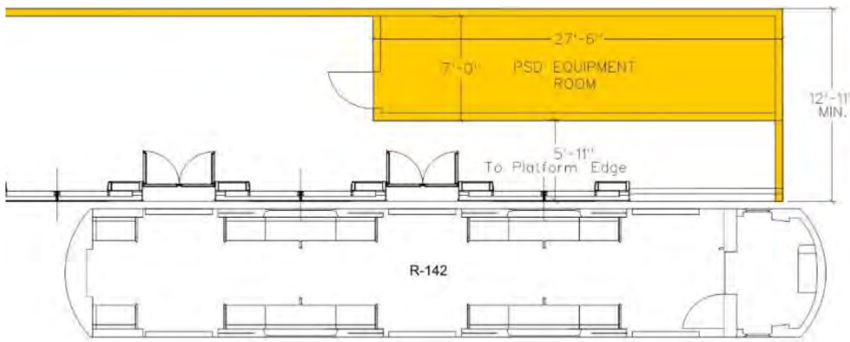

Figure 2 – *Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimension

1.05 – MR 344 | Kingston Avenue

Summary: *Kingston Avenue Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

Kingston Avenue Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. Platform widths vary from 7'-10" to 11'-10". There is a single row of columns on each platform.

Due to the limited width of the existing platforms, there is no available space for the equipment room. Figure 2 below shows the minimum width required (12'-11") for construction of a PSD equipment room on a station platform. Figure 1, below, demonstrates the lack of available space within the main control area.

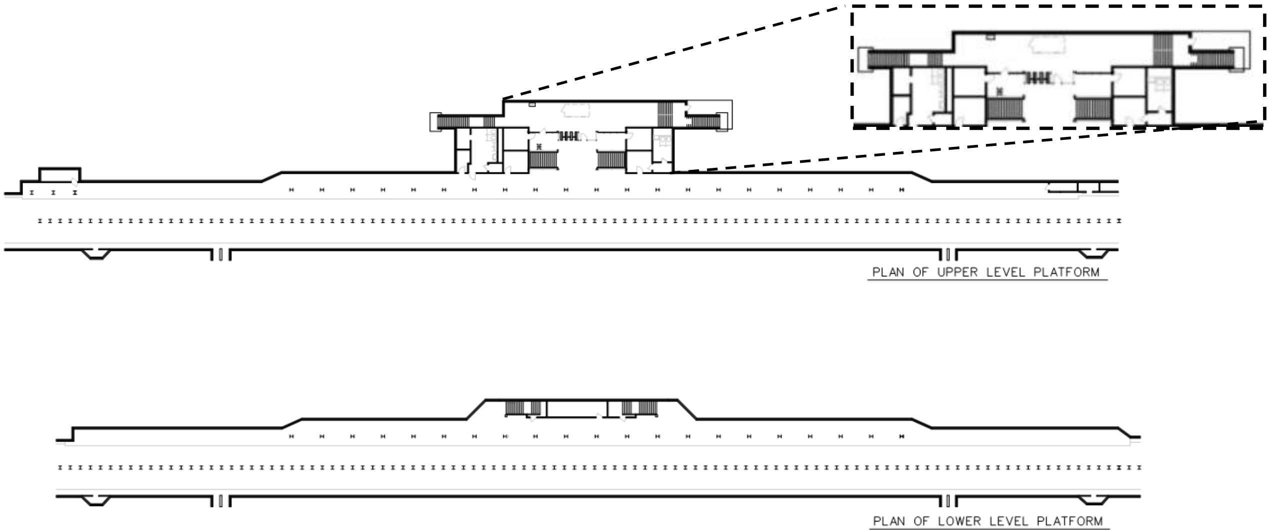

Figure 1 *– Congested/Narrow Station Plan*
Kingston Avenue

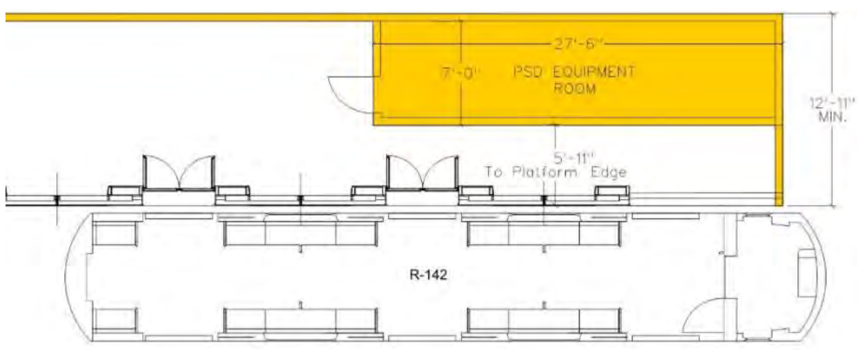

Figure 2 – *Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimension

1.06 – MR 345 | Crown Heights / Utica Avenue

Summary: *Crown Heights Station is not feasible for both APGs and PSDs as the columns which are located 12" from the platform edge would impede installation, access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Crown Heights Station is a below-grade station consisting of two center / island platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platform which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 12" from the platform edge. This dimension does not allow for installation and maintenance of the 15"-wide APG/PSD system. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 12" from the edge*
Crown Heights Utica Avenue

1.07 – MR 346 | Sutter Avenue

Summary: *Sutter Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Sutter Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 8'-10" to 9'-10". The platforms are straight with one row of columns inset in the windscreen. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Sutter Avenue Station

Figure 2 *– Precast Slab*
Sutter Avenue Station

1.08 – MR 353 | President Street Station

Summary: *President Street is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at five platform stairs as the remaining width would be 27" (see figure 1).*

Description

President Street Station is a below-grade station with one straight center / island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 20'-0" throughout. The corridor width at southern end of this platform is 42". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 27" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
President Street Station

1.09 – MR 354 | Sterling Street Station

Summary: *Sterling Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power capacity could not be ascertained due to inaccessibility during survey. However, a lack of adequate existing power is not considered to be a determining factor of future feasibility.*

Description

Sterling Street Station is a below-grade station with two side platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are located throughout the length of the platforms along the platform edge. The platform widths are approximately 11-10" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located in the station mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges appear to be original to the station construction. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would be required for the installation of both an APG and PSD system.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for '5' Line Stations
(Sterling Street Station)

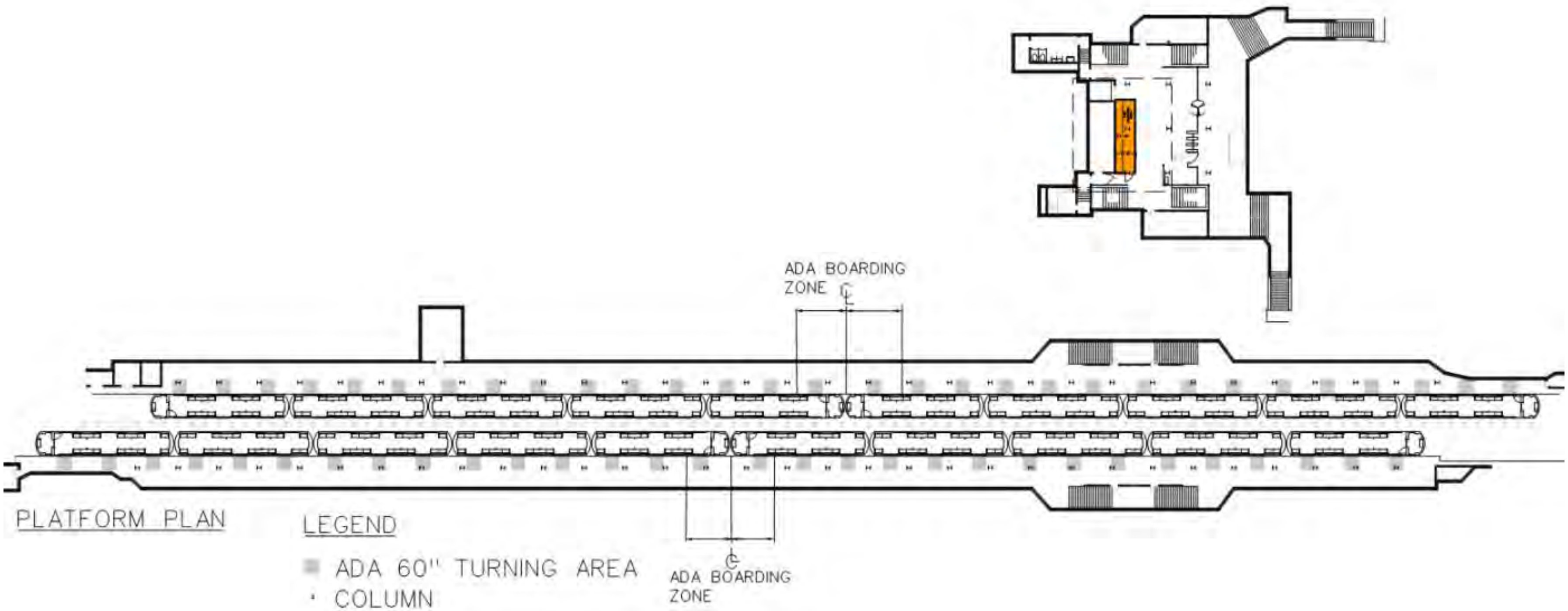

***Figure 1** – Overall Station Plan*
Sterling Street Station

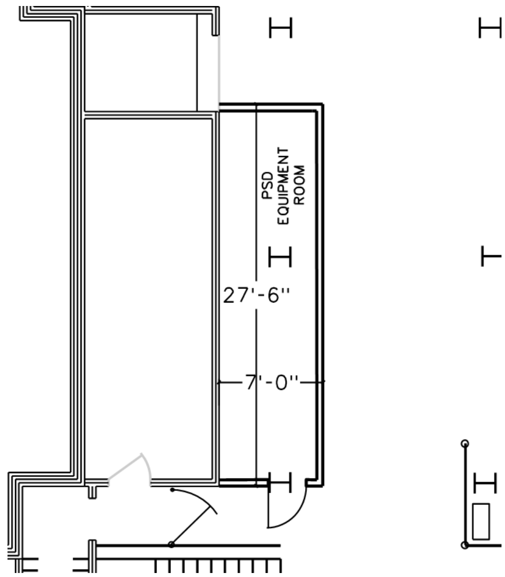

Figure 2 – *PSD Equipment Room 1 Detail*
Sterling Street Station

Figure 3 – *Typical platform view*
Sterling Street Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:
Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:
An analysis of adequate electrical power at this station could not be performed due to inaccessibility during survey. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $26.7M to install APGs and $33.4M to install PSDs (See Appendix E)

1.10 – MR 355 | Winthrop Street Station

Summary: *Winthrop Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 29" (see figure 1).*

Description

The Winthrop Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-8' to 11'-10". The corridor width at the southbound end of the platforms is 3'-8". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 29" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
Winthrop Street Station

1.11 – MR 356 | Church Avenue Station

Summary: *Church Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

Church Avenue Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns along each platform edge. The platform width varies from 7'-10" to 11'-10" throughout. Due to the extremely limited width of the existing platforms and control areas, there is no available space for the equipment room. Figure 2 below shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the southbound control area. The northbound control area is similar.

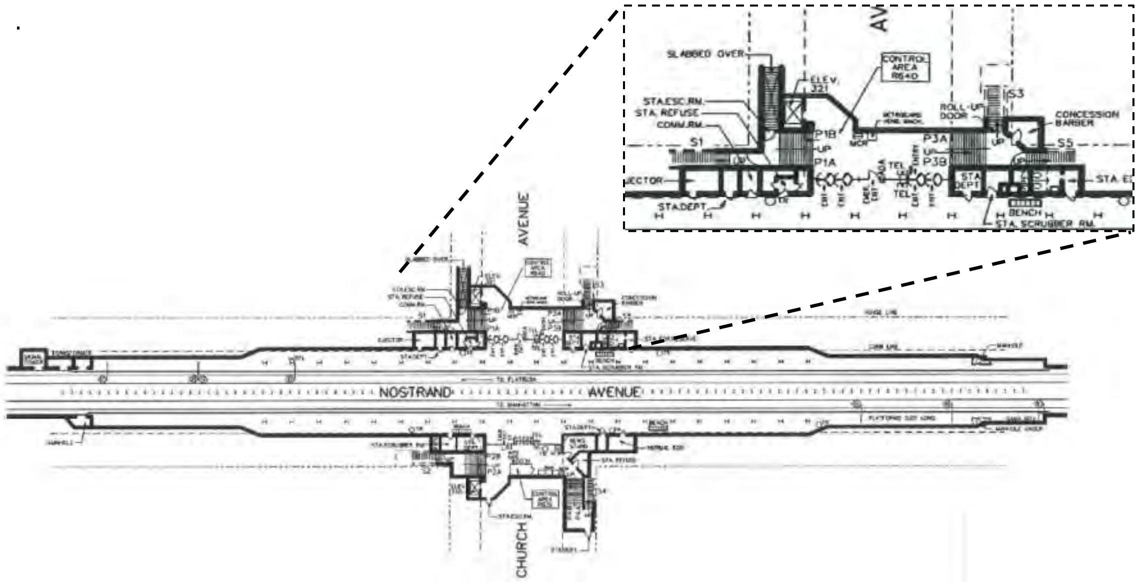

***Figure 1 –** Congested / Narrow Station Plan*
Church Avenue Station

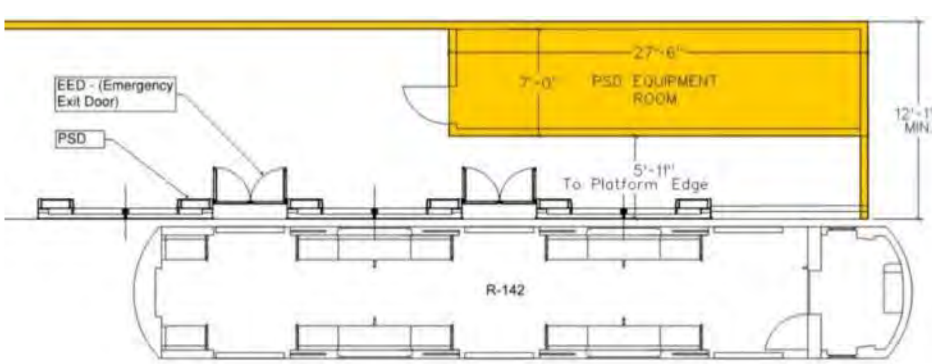

***Figure 2 –** Diagram demonstrating minimum platform width dimensions*
Church Avenue Station

1.12 – MR 357 | Beverly Road Station

Summary: *Beverly Road Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the north end of the northbound platform as the existing width is 5'-9" (see figure 1).*

Description

Beverly Road Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-9' to 11'-10".

Platform width at the north end of the northbound platform is 5'-9" or 69". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

***Figure 1** – Non-Compliant egress condition*
Beverly Road Station

1.13 – MR 358 | Newkirk Avenue Station

Summary: *Newkirk Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the both platforms as the existing width is 5'-9" (see figure 1).*

Description

Newkirk Avenue Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-9' to 11'-10".

Platform width at the ends of the northbound & southbound platform are 5'-9" or 69". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

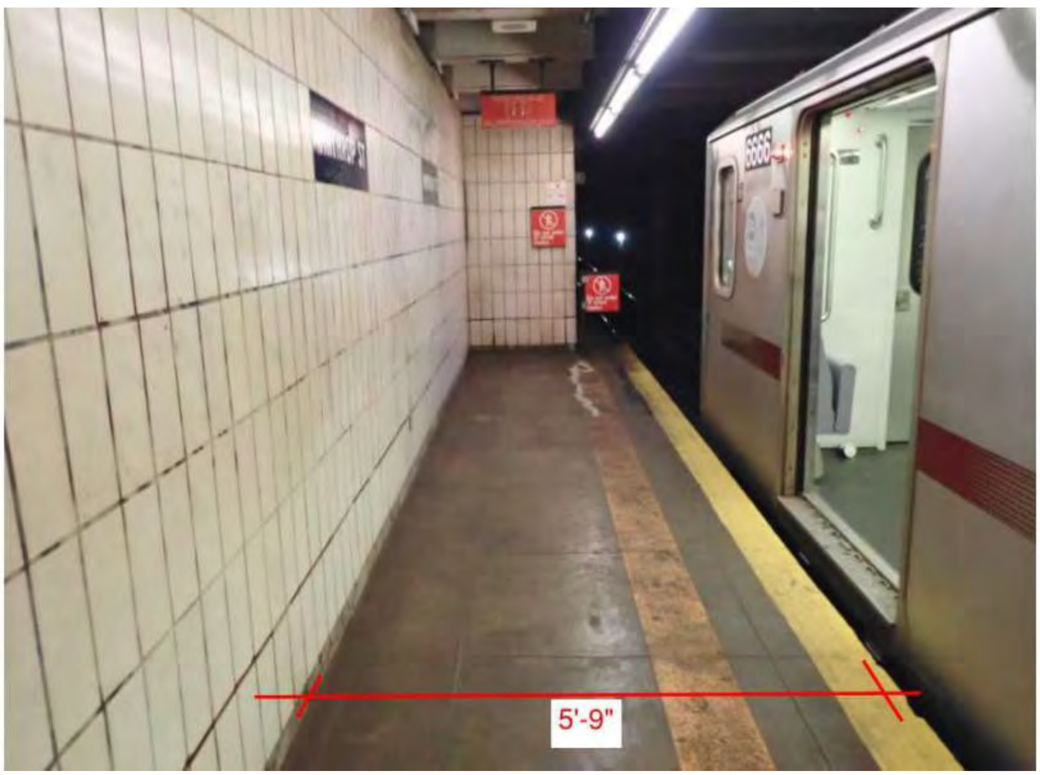

***Figure 1** – Non-Compliant egress condition*
Newkirk Avenue Station

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1.14 – MR 359 | Flatbush Avenue Brooklyn College Station

Summary: *Flatbush Avenue Brooklyn College Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 13" (see figure 1).*

Description

The Flatbush Avenue Brooklyn College Station is a below-grade terminus station with two straight side platforms. The platform structures are cast-in-place concrete. The corridor width at the northern end of the northbound platform is 2'-4". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 13" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Area of ADA non-compliance*
Flatbush Avenue Brooklyn College Station

1.15 – MR 391 | 138th Street Grand Concourse

Summary: *138th Street Grand Concourse Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

The 138th Street Grand Concourse Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-4' to 11'-6". The implementation of a platform edge barrier would reduce the lesser width below the required minimum of 36". The remaining 25" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-compliant ADA condition*
138th Street Grand Concourse Station

1.16 – MR 392 | 125th Street

Summary: *125th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

125th Street Station is a below-grade station with two levels of straight center / island platforms. The no. 4 train utilizes both the upper and lower level. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-4' to 29'-8". At the lower platform, the implementation of a platform edge barrier would reduce the lesser width below the required minimum of 36". The remaining 25" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

The upper platform is infeasible for both APGs and PSDs due to the presence of structural columns on the platform which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 2 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA clearance*
North end of lower platform; 125th Street Station

***Figure 2** – Columns at 16" from platform edge*
South end of upper platform

1.17 – MR 393 | 116th Street

Summary: *116th Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

116th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. Platform widths vary from 7'-8" to 11'-10". There is a single row of columns on each platform.

Due to the limited width of the existing platforms, there is no available space for the equipment room. Figure 2 below shows the minimum width required (12'-11") for construction of a PSD equipment room on a station platform. Figure 1, below, demonstrates the lack of available space within the main control area.

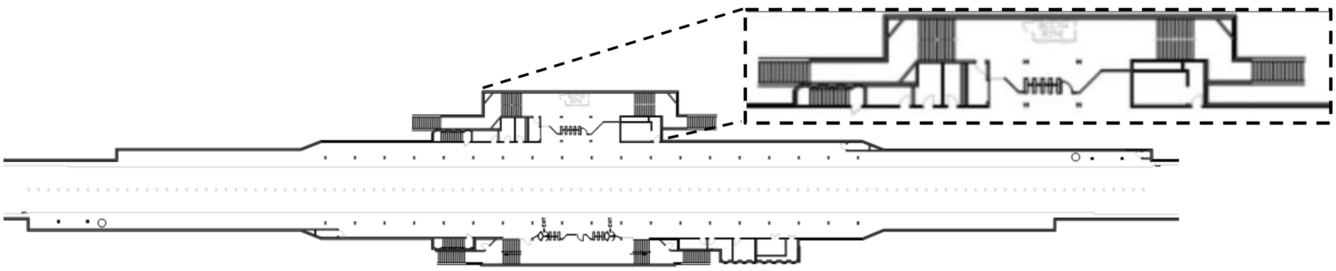

Figure 1 *– Congested/Narrow Station Plan*
116th Street Station

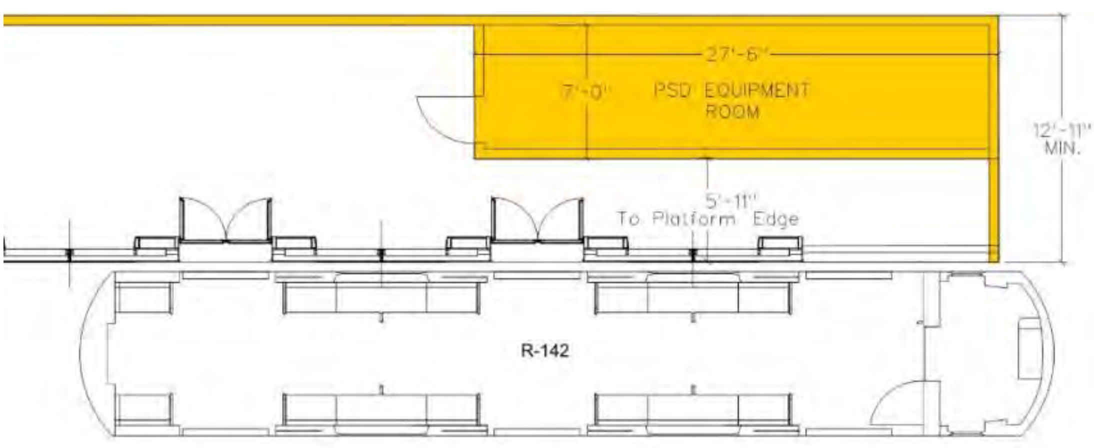

Figure 2 – *Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimension

1.18 – MR 394 | 110th Street

Summary: *110th Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

110th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. Platform widths vary from 7'-8" to 8'-0".

Due to the limited width of the existing platforms, there is no available space for the equipment room. Figure 2 below shows the minimum width required (12'-11") for construction of a PSD equipment room on a station platform. Figure 1, below, demonstrates the lack of available space within the main control area.

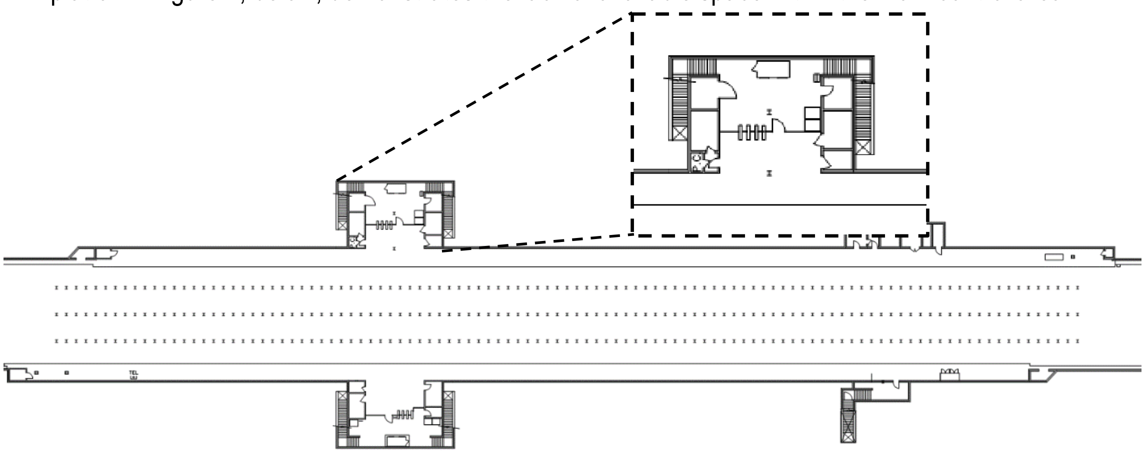

***Figure 1** – Congested/Narrow Station Plan*
110th Street Station

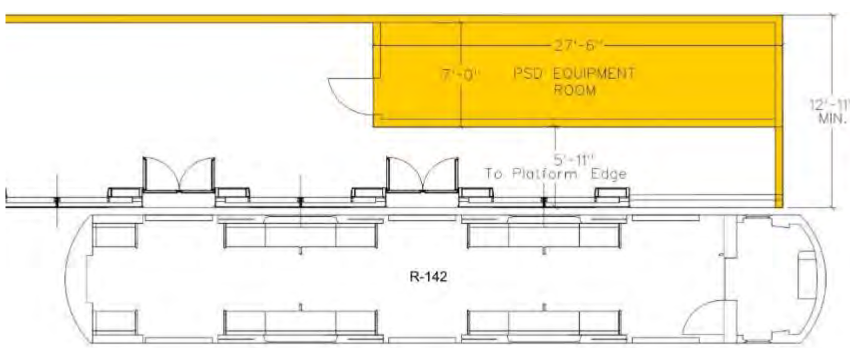

***Figure 2 –** Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimension

1.19 – MR 395 | 103rd Street

Summary: *103rd Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

103rd Street Station is a below ground station with two side platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns located throughout the platforms. The platform widths are approximately 7-4" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the mezzanine control area of the station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

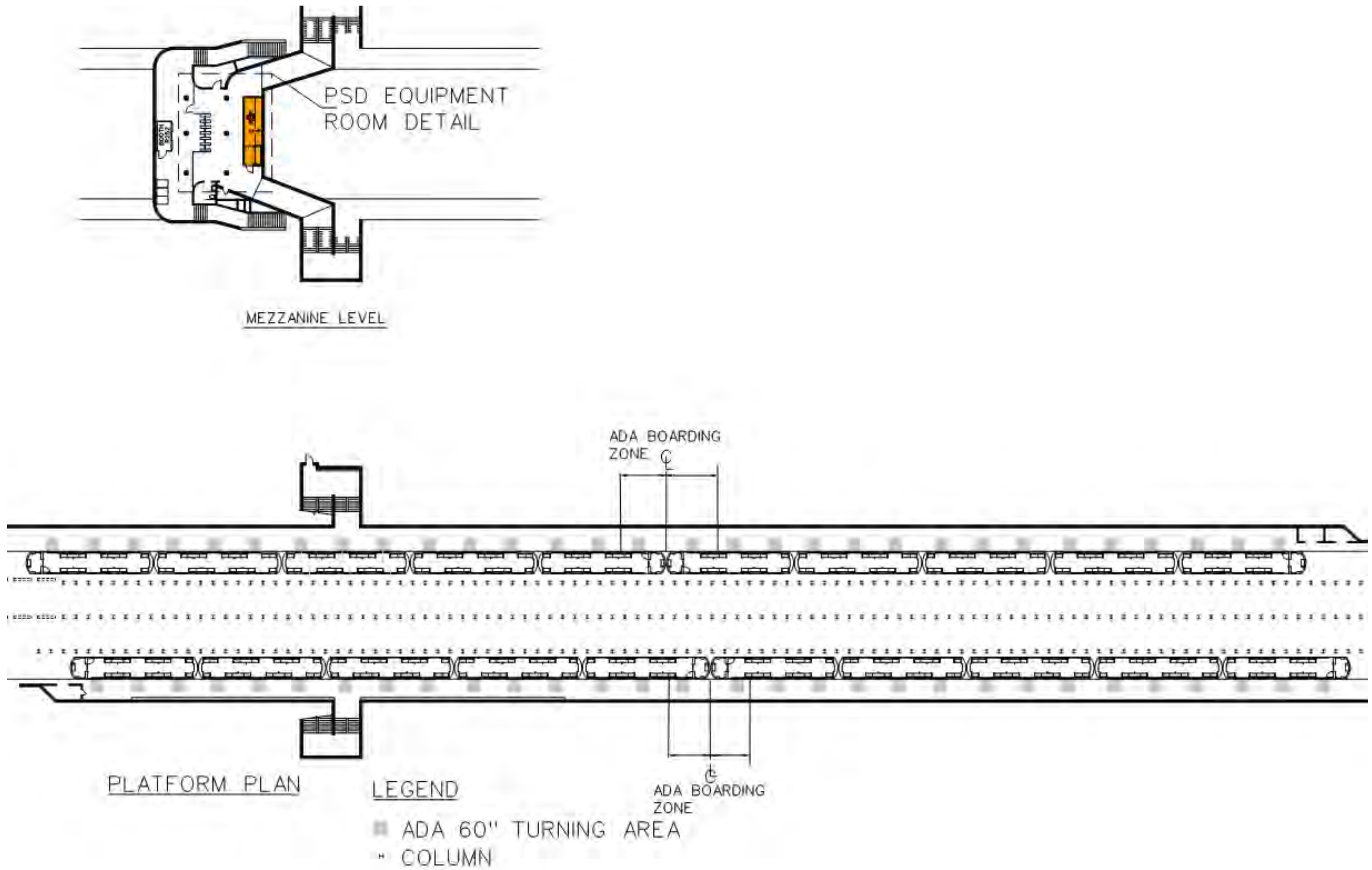

Figure 1 *– Overall Station Plan*
103rd Street Station

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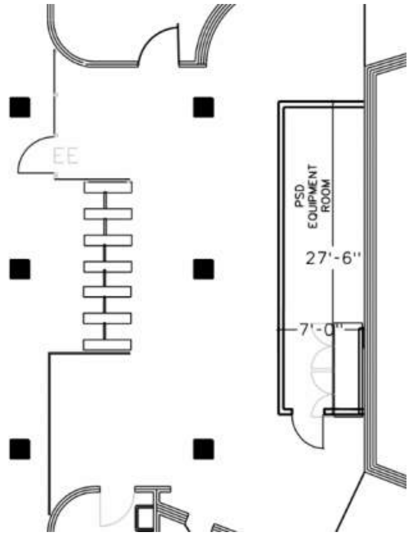

Figure 2 *– PSD Equipment Room 1 Detail*
103rd Street Station

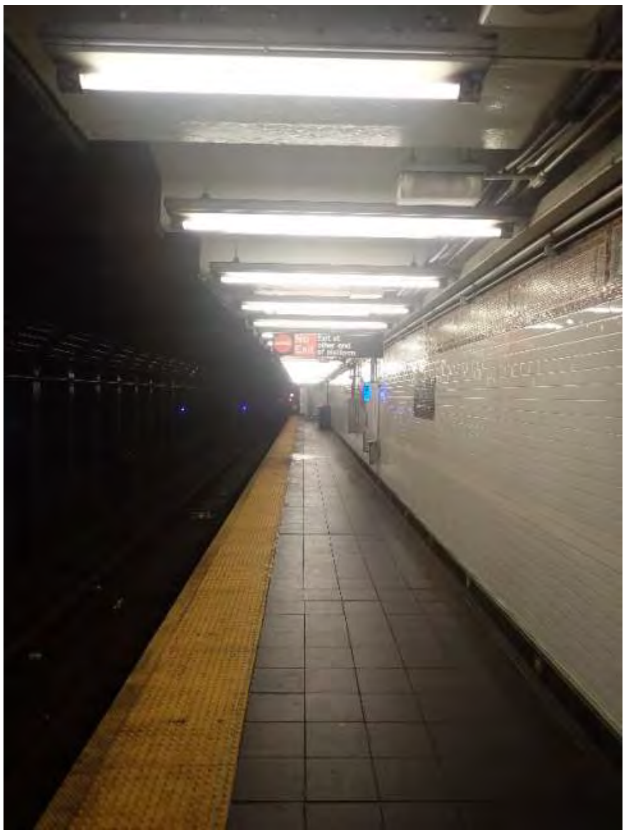

Figure 3 *– Typical platform view*
103rd Street Station

Platform obstructions within 5' of edge:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. An analysis of electrical reserve service could not be performed due to inaccessibility during survey. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal service)

Station Name	103rd Street
Peak Demand Load from ConEd Report, (kW)	26.8
Apparent Power (kVA)	33.5
Station Peak Demand Load, Max Current, (A)	93.1
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	251.2
Station Service Power Capacity, (Main SB or SG Rating), (A)	400.0
Service Spare Capacity, (A)	148.9
Is Electrical Service Adequate?	**Yes**
Notes	Service rating of 400A is based on field observations. Station has only (1) meter readings for Normal service. The station Reserve meter was NOT accessible during field survey. (No meter in Reserve EDR) 1 Line diagram provided is not current.

Table 1*. Normal Service Power Capacity Analysis*

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Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.6M to install APGs and $34.5M to install PSDs (See Appendix E)

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1.20 – MR 396 | 96th Street

Summary: *96th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the north end of the southbound platform as the existing width is 5'-0" (see figure 1).*

Description

96th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-0' to 12'-10".

The platform width at the end of the southbound platform is 5'-0" or 60". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

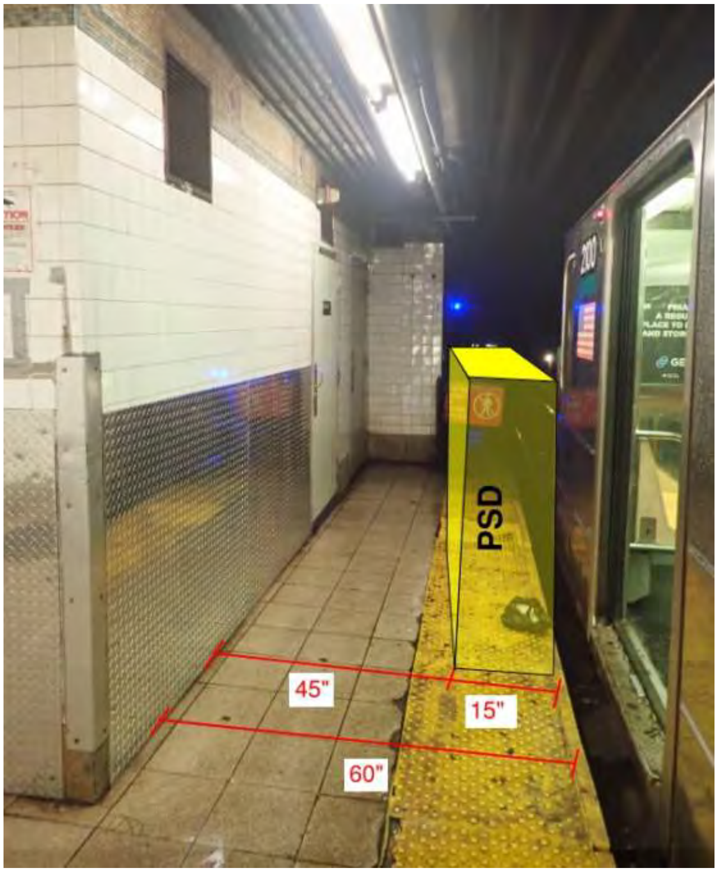

Figure 1 *– Non-Compliant egress condition*
96th Street Station

1.21 – MR 397 | 86th Street

Summary: *86th Street is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at the center stairs as the remaining width would be 31" (see figure 1).*

Description

The 86th Street Station is a below-grade station consisting of two side platforms on two levels. The No. 4 service normally runs at the lower level, with night service on the upper level. At the upper level, the platforms are approximately 13'-8" wide. The platforms are straight with one rows of columns at 46" from the edge of the platform. The implementation of a platform edge barrier would reduce this width to 31" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

The 86th Street lower level is infeasible due to lack of space for a PSD equipment room. The introduction of an equipment room on the lower platform would create 24" pinch points at the columns which do not comply with the minimum 32" required by ADA.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA dimension*
86th Street Station

1.22 – MR 398 | 77th Street

Summary: *77th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

The 77th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-4' to 11'-8". The implementation of a platform edge barrier would reduce the lesser width below the required minimum of 36". The remaining 25" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
77th Street Station

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1.23 – MR 399 | 68th Street Hunter College

Summary: *68th Street Hunter College Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of both platforms as the existing width is 4'-2" (see figure 1).*

Description

68th Street Hunter College Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 4'-2' to 11'-10".

Platform width at the southbound end of the northbound & southbound platform is 4'-2" or 50". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

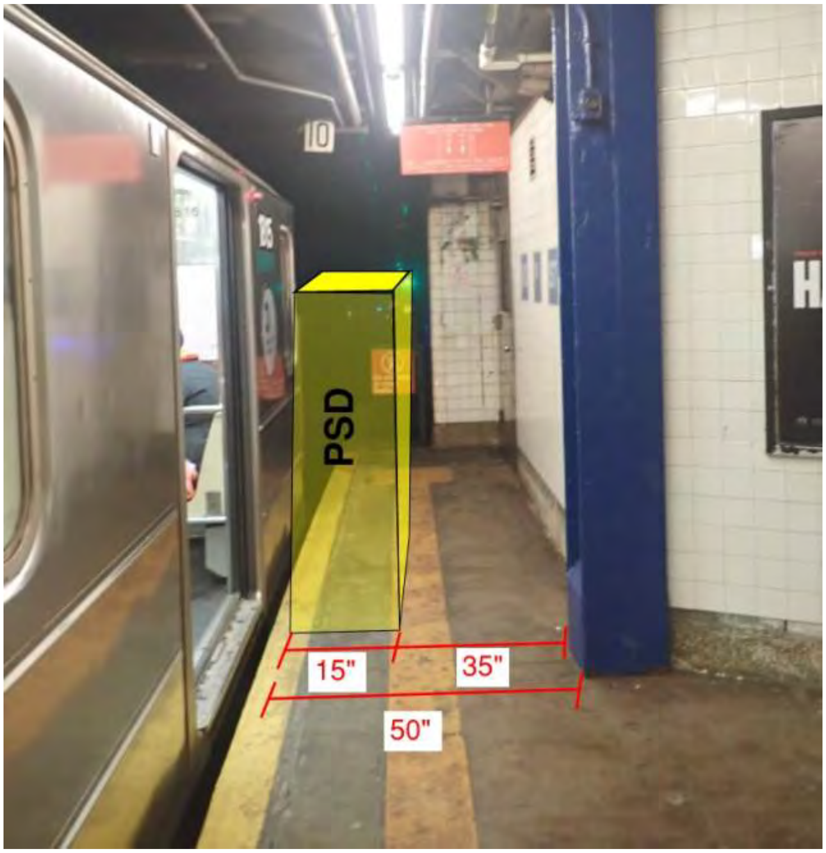

***Figure 1** – Non-Compliant egress condition*
68th Street Hunter College Station

1.24 – MR 400 | 59th Street

Summary: *59th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

The 59th Street Station is a below-grade station with two levels of two straight side platforms. The No. 4 service runs normally on the lower platform, with night service on the upper platform. The upper level platform will be the subject of a future report for the No. 6 line. The platform structures are cast-in-place concrete. The width of the lower level platforms ranges from 3'-4' to 13'-0". The implementation of a platform edge barrier would reduce the lesser width below the required minimum of a 32" pinch point. The remaining 25" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

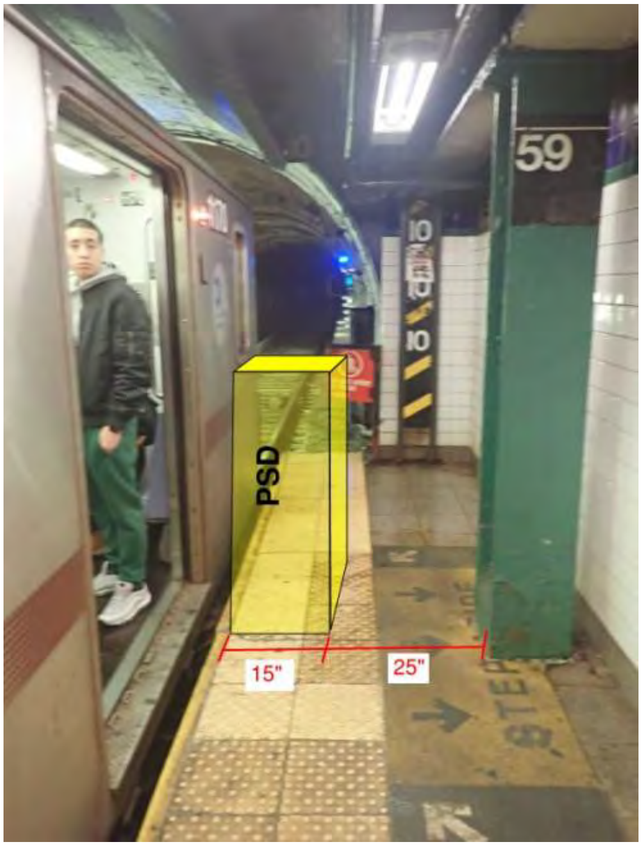

Figure 1 *– Non-Compliant egress condition*
59th Street Station- lower level

1.25 – MR 402 | 42nd Street Grand Central

Summary: *42nd Street Grand Central Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 31" (see figure 1).*

Description

The 42nd Street Grand Central Station is a below-grade station with two straight center / island platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-10' to 24'-0". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 31" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

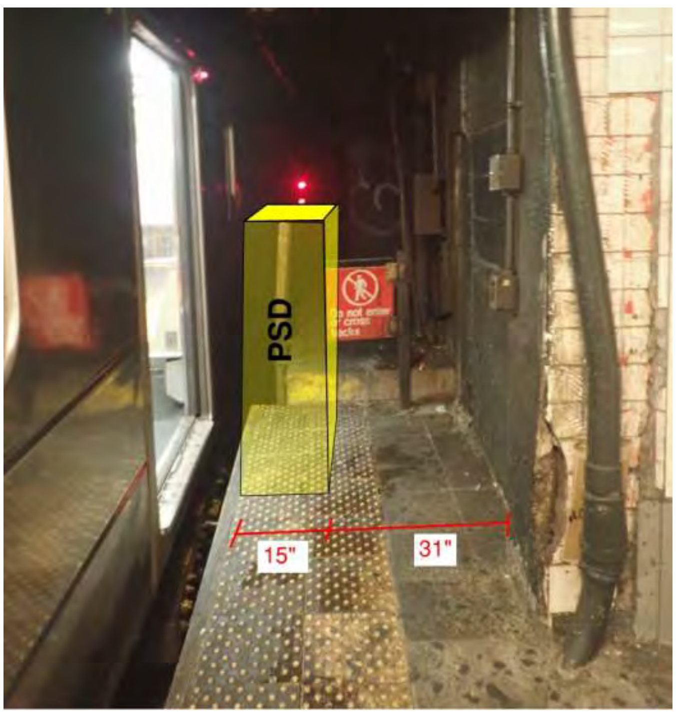

Figure 1 *– Non-compliant ADA condition*
42nd Street Grand Central Station

1.26 – MR 406 | 14th Street Union Square

Summary: *14th Union Square Station is not feasible for both APGs and PSDs due to the presence of platform edge gap fillers located at all southbound platform edges. The existing gap fillers are a dynamic assembly that extends the platform edge when a train arrives, and recedes when the train departs. This moving assembly prevents the installation of a static PSD system. Please see figure 1 for reference.*

Description:

Due to the sharp curvature of the platforms at 14th Street Union Square, platform edge gap fillers are necessary to bridge the gap between the current rolling stock's doors and the platform edge.

Figure 1 –*Platform Edge Gap Fillers*
14th Street Union Square Station

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1.27 – MR 411 | Brooklyn Bridge City Hall

Summary: *Brooklyn Bridge City Hall Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at the center stairs as the remaining width would be 17" (see figure 1).*

Description

The Brooklyn Bridge City Hall Station is a below-grade station consisting of two center / island platforms. The platforms are approximately 15'-6" to 21'-2" wide. The platforms are mildly curved with two rows of columns at 32" from the edge of the platform. The implementation of a platform edge barrier would reduce this width to 17" or less* which would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
Brooklyn Bridge City Hall Station

1.28 – MR 412 | Fulton Street

Summary: *Fulton Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Fulton Street Station is a below-grade station with two side platforms (**see Figure 1**). The platform structures are cast-in-place concrete. Columns are located throughout the platforms along the platform edge. Column faces measure approximately 3'-2" from the platform edge. The platform widths range from approximately 7'-6" to 19'-4" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located on the southbound platform of the station (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past five years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for '5' Line Stations
(Fulton Street Station)

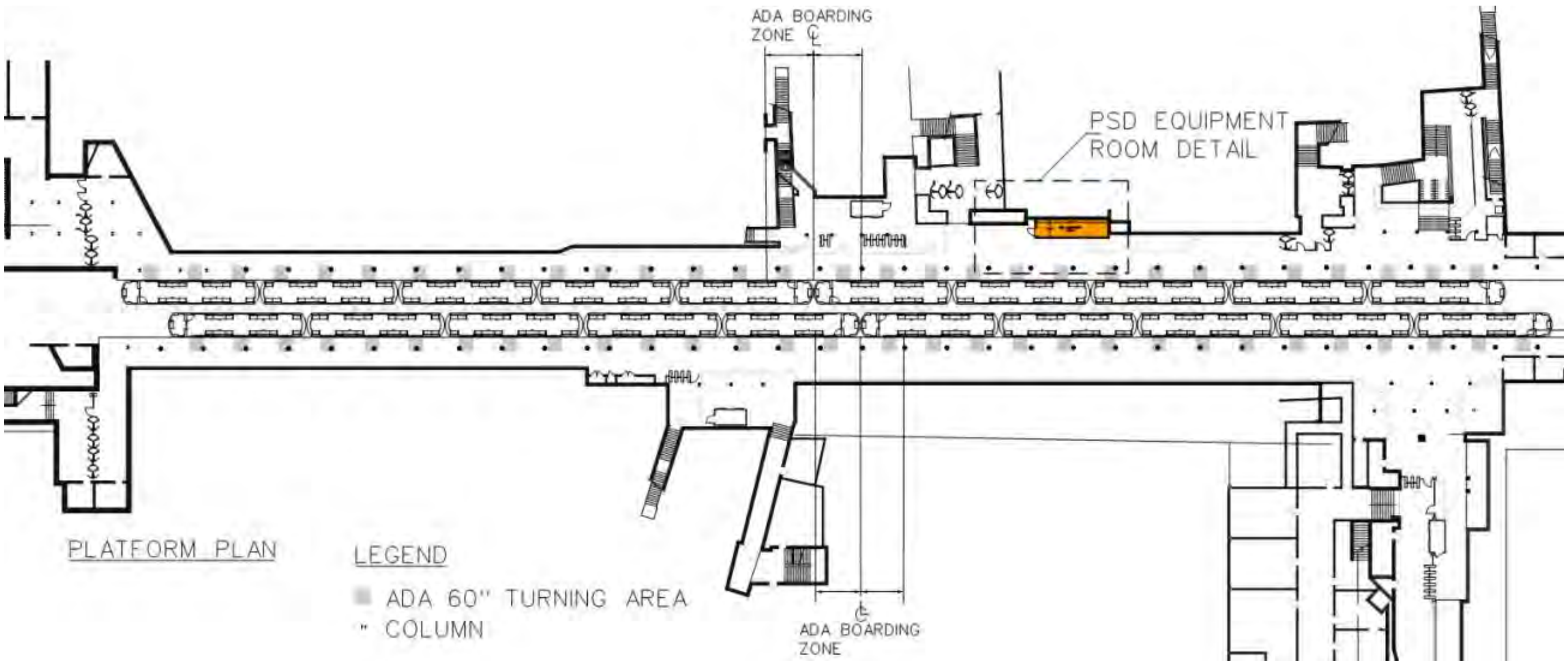

Figure 1 – Overall Station Plan
Fulton Street Station

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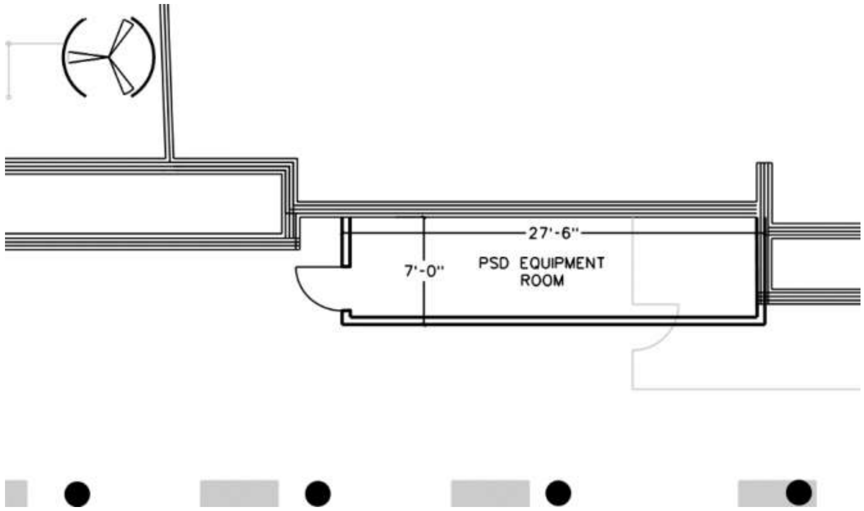

Figure 2 – PSD Equipment Room 1 Detail
Fulton Street Station

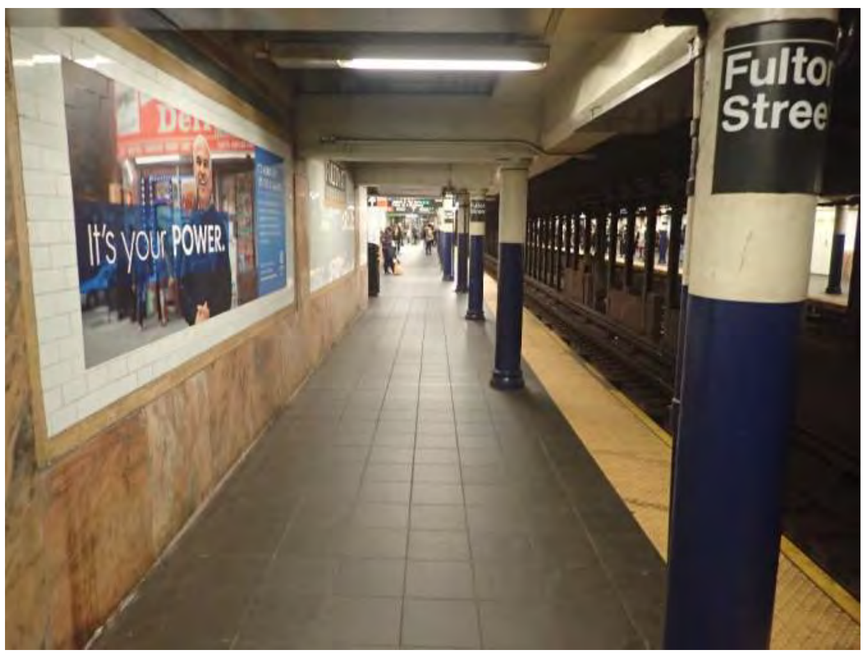

Figure 3 – Typical platform view
Fulton Street Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted both parallel and perpendicular to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 & Table 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal Service. SS-3)

Station Name	Fulton Street
Peak Demand Load from ConEd Report, (KW)	231.4
Apparent Power (kVA)	289.2
Station Peak Demand Load, Max Current, (A)	803.3
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	961
Station Service Power Capacity, (Main SB or SG Rating), (A)	9222.22
Service Spare Capacity, (A)	8261
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey. 1 line diagram provided does not match field survey. Station has total (3) services (SS-1,SS-2 & SS-3) @ 480 Volt and has (3) associated meters. The 480 V data is converted to 208 V units. This analysis is for **Normal service** meter reading provided for Service 'SS-3' @ Rm# T5-09.

***Table 1**. Normal Service Power Capacity Analysis*

Station
Power Capacity Analysis (Normal+ Reserve Service)

Station Name	Fulton Street
Peak Demand Load from ConEd Report, (KW)	1182.2
Apparent Power (kVA)	1477.8
Station Peak Demand Load, Max Current, (A)	4945.8
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	5104
Station Service Power Capacity, (Main SB or SG Rating), (A)	18444.44
Service Spare Capacity, (A)	13341
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey. 1-line diagram provided does not match field survey. Station has total (3) services (SS-1,SS-2 & SS-3) @ 480 Volt and has (3) associated meters.The 480 V data is converted to 208 V units. This analysis is for combined **Normal & Reserve service** meter reading provided for Service 'SS-1' @ Rm# T5-09 and Service 'SS-2' @ Rm# T5-08.

***Table 2**. Norma l Reserve Service Power Capacity Analysis*

Historic Restrictions:
This station is a designated historical place. As such, any capital improvement will be subject to review by the State Historic Preservation Office.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.5M to install APGs and $34.6M to install PSDs (See Appendix E)

1.29 – MR 413 | Wall Street

Summary: *Wall Street Station is not feasible for both APGs and PSDs as the columns which are located 20" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Wall Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 20" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 20" from the edge*
Wall Street Station

1.30 – MR 414 | Bowling Green

Summary: *Bowling Green Station is feasible for both APGs and PSDs. Two structural columns will need to be relocated due to their proximity to the platform edge. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Bowling Green Station is a below-grade station with one side platform & one center / island platform that has only one active platform edge (**see Figure 1**). The platform structures are cast-in-place concrete. Columns are located throughout the platforms along the platform edges. Column faces measure approximately 2'-2" from the platform edge. Two columns on the southbound platform measure 17" from the platform edge. The platform widths range approximately from 14-0" – 24'-0" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located on the northbound platform of the station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are approximately tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

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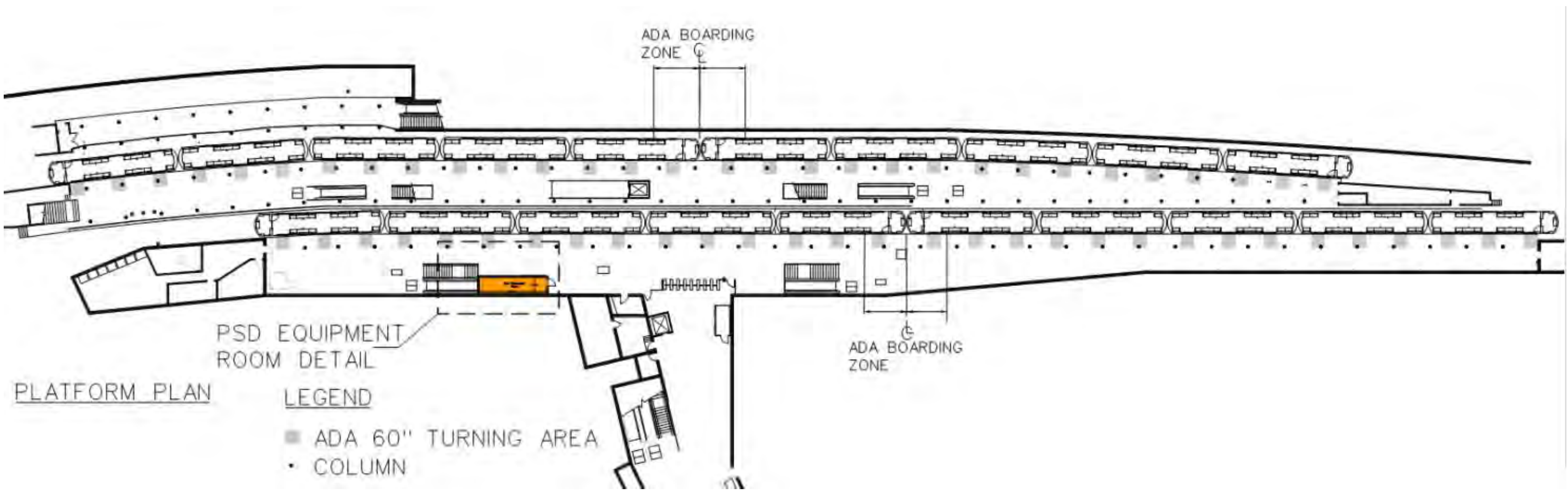

Figure 1 – *Overall Station Plan*
Bowling Green Station

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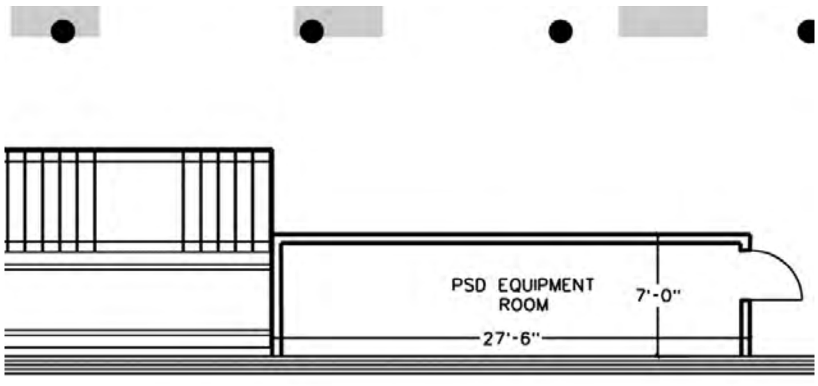

Figure 2 *– PSD Equipment Room 1 Detail*
Bowling Green Station

Figure 3 *– Typical platform view*
Bowling Green Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 & Table 2 please see the Power Capacity Analysis for this station.

Station

Power Capacity Analysis (Normal Service)

Station Name	Bowling Green Bway
Peak Demand Load from ConEd Report, (kW)	102.4
Apparent Power (kVA)	128.0
Station Peak Demand Load, Max Current, (A)	355.6
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	514
Station Service Power Capacity, (Main SB or SG Rating), (A)	1600
Service Spare Capacity, (A)	1086
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on 1 line diagram drawing from field, having 1600 A Service switch. Station has (2) separate meter readings for each Normal & Reserve service. This analysis is for **Normal service**.Note that Power Demand Data provided is interchanged between Normal & Reserve meter.

Table 1. *Normal Service Power Capacity Analysis*

Station
Power Capacity Analysis (Reserve Service)

Station Name	Bowling Green Bway
Peak Demand Load from ConEd Report, (kW)	163.2
Apparent Power (kVA)	204.0
Station Peak Demand Load, Max Current, (A)	566.7
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	725
Station Service Power Capacity, (Main SB or SG Rating), (A)	1600
Service Spare Capacity, (A)	875
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on 1 line diagram drawing from field, having 1600 A Service switch. Station has (2) separate meter readings for each Normal & Reserve service. This analysis is for **Reserve service**.Note that Power Demand Data provided is interchanged between Normal & Reserve meter.

Table 2. Reserve Service Power Capacity Analysis

Historic Restrictions:
This station is a designated historical place for its original entrance & control house. As such, any capital improvement will be subject to review by the State Historic Preservation Office.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.3M to install APGs and $33.8M to install PSDs (See Appendix E)

1.31 – MR 415 | Borough Hall Station

Summary: *Borough Hall Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Borough Hall Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 16" from the edge*
Borough Hall Station

1.32 – MR 417 | 238th Street Nereid Avenue Station

Summary: *238th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The 238th Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 12'-0" to 12'-4". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
238th Street Station

Figure 2 *– Precast Slab*
238th Street Station

1.33 – MR 418 | 233rd Street Station

Summary: *233rd Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The 233rd Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 12'-0" to 12'-6". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
233rd Street Station

Figure 2 *– Precast Slab*
233rd Street Station

1.34 – MR 419 | 225th Street Station

Summary: *225th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The 225th Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The platforms widths are approximately 12'-0" throughout. The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
225th Street Station

Figure 2 *– Precast Slab*
225th Street Station

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1.35 – MR 420 | 219th Street Station

Summary: *219th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The 219th Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 12'-0" to 12'-4". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
219th Street Station

Figure 2 *– Precast Slab*
219th Street Station

1.36 – MR 421 | Gun Hill Road Station

Summary: *Gun Hill Road Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Gun Hill Road Station is an elevated station with two center / island platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 14'-0" to 16'-8". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Gun Hill Road Station

Figure 2 *– Precast Slab*
Gun Hill Road Station

1.37 – MR 422 | Burke Avenue Station

Summary: *Burke Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Burke Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 12'-2" to 12'-4". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Burke Avenue Station

Figure 2 *– Precast Slab*
Burke Avenue Station

1.38 – MR 423 | Allerton Avenue Station

Summary: *Allerton Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Allerton Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 12'-0" to 12'-6". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Allerton Avenue Station

Figure 2 *– Precast Slab*
Allerton Avenue Station

1.39 – MR 424 | Pelham Parkway Station

Summary: *Pelham Parkway Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Pelham Parkway Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 12'-8" to 13'-10". The platforms are straight with cantilevered beams supporting their respective station canopies. See figure 1 & 2 for reference.

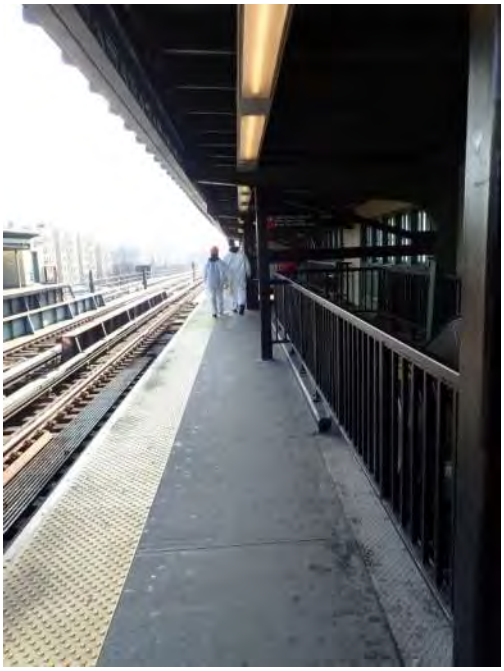

Figure 1 *– General Station Condition*
Pelham Parkway Station

Figure 2 *– Precast Slab*
Pelham Parkway Station

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1.40 – MR 425 | Bronx Park East Station

Summary: *Bronx Park East Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Bronx Park East Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 12'-0" to 12'-6". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Bronx Park East Station

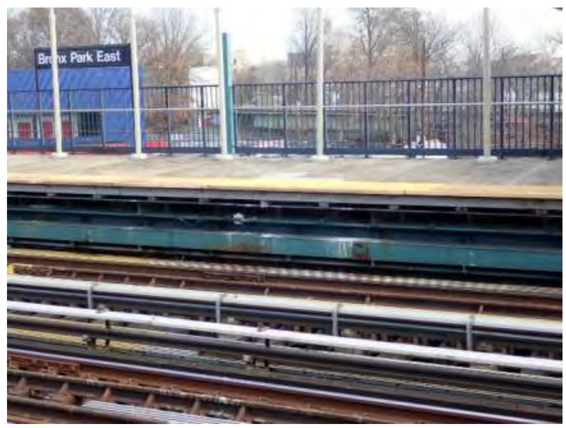

Figure 2 *– Precast Slab*
Bronx Park East Station

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1.41 – MR 426 | East 180th Street Morris Pk Station

Summary: *East 180th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The East 180th Street Station is an elevated station with two center / island platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 16'-6" to 16'-8". The platforms are straight with two rows of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
East 180th Street Station

Figure 2 *– Precast Slab*
East 180th Street Station

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1.42 – MR 427 | West Farm Sq. / E. Tremont Ave Station

__Summary:__ West Farms Square Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).

Description

The West Farms Square Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 13'-8" to 13'-10". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
West Farms Square Station

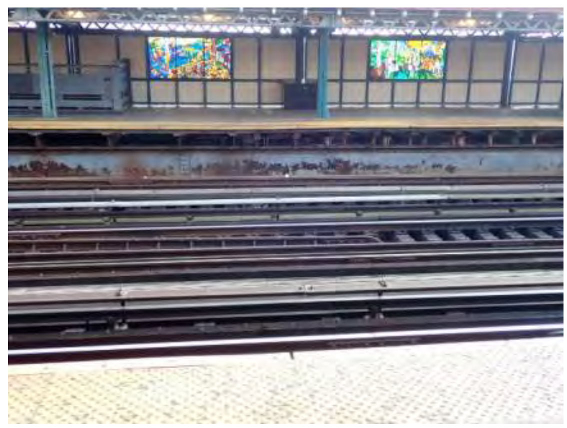

Figure 2 *– Precast Slab*
West Farms Square Station

1.43 – MR 428| 174th Street Station

Summary: *174th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The 174th Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 7'-8" to 12'-4". The platforms are mildly curved with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
174th Street Station

Figure 2 *– Precast Slab*
174th Street Station

1.44 – MR 429 | Freeman Street Station

Summary: *Freeman Street is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Freeman Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 7'-0" to 13'-8". The platforms are mildly curved with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Freeman Street Station

Figure 2 *– Precast Slab*
Freeman Street Station

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1.45 – MR 430 | Simpson Street Station

Summary: *Simpson Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Simpson Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 6'-0" to 13'-10". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Simpson Street Station

Figure 2 *– Precast Slab*
Simpson Street Station

1.46 – MR 431 | Intervale Avenue Station

Summary: *Intervale Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Intervale Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 6'-0" to 13'-10". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

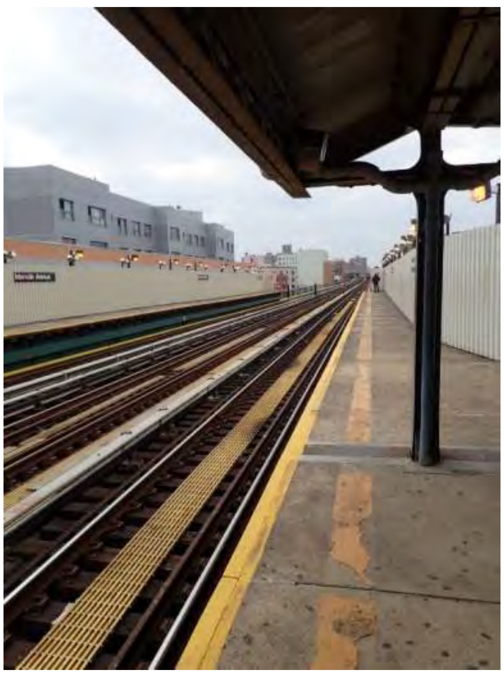

Figure 1 *– General Station Condition*
Intervale Avenue Station

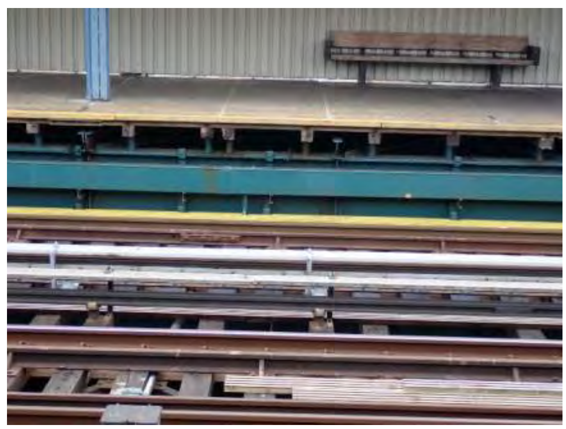

Figure 2 *– Precast Slab*
Intervale Avenue Station

1.47 – MR 432 | Prospect Avenue Station

Summary: *Prospect Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Prospect Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 7'-4" to 14'-4". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Prospect Avenue Station

Figure 2 *– Precast Slab*
Prospect Avenue Station

1.48 – MR 433 | Jackson Avenue Station

Summary: *Jackson Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Jackson Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 6'-6" to 14'-0". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Jackson Avenue Station

Figure 2 *– Precast Slab*
Jackson Avenue Station

1.49 – MR 434 | 3rd Avenue 149th Street Station

Summary: *3rd Avenue 149th Street Station is not feasible for both APGs and PSDs as the columns which are located 18" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

3rd Avenue 149th Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 18" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 18" from the edge*
3rd Avenue 149th Street Station

1.50 – MR 435 | 149th Street Grand Concourse Station

Summary: *149th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 35" (see figure 1).*

Description

The 149th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The corridor width at the western ends of the platforms is 4'-2". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 35" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
149th Street Station

1.51 – MR 442 | Eastchester Dyre Avenue

Summary: *Eastchester Dyre Avenue Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

The Eastchester Dyre Avenue Station is an embankment station with one straight center island platform. The platform structure is cast-in-place concrete. The platform width is 14'-10" throughout. Due to the limited width of the existing platform, there is no available space for the equipment room. Figure 2 below shows the minimum width required for a center/island platform (19'-4") for construction of a PSD equipment room on a station platform. Figure 1, below shows the station plan.

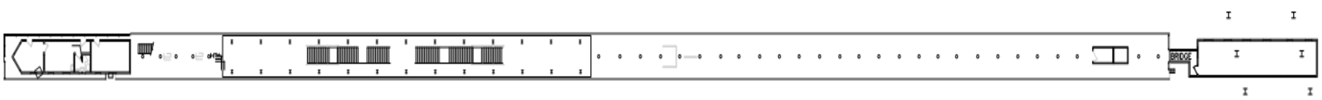

Figure 1 *– Congested/Narrow Station Plan*
Eastchester Dyre Station

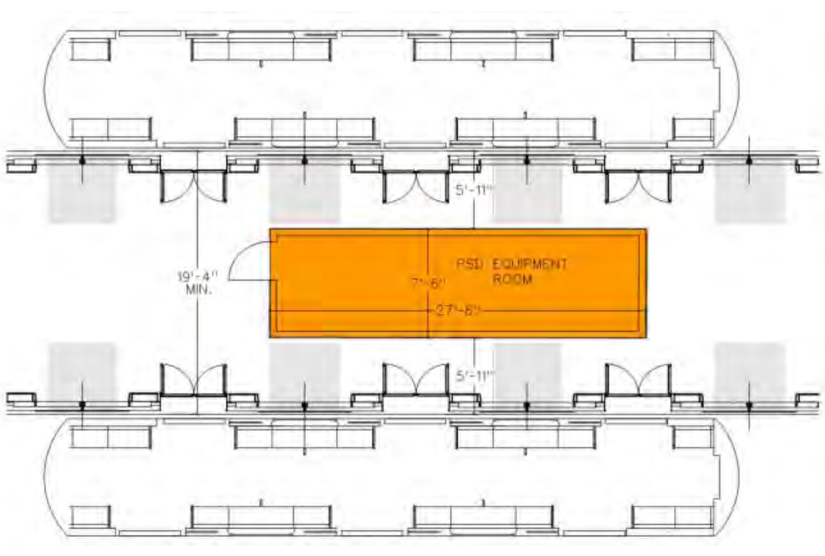

Figure 2 – *Diagram demonstrating minimum platform width dimensions for center/island platform (A Division train shown; B Division requires same dimension*

1.52 – MR 443 | Baychester Avenue

Summary: *Baychester Avenue Station is feasible for APGs only. Due to a lack of overhead structure at much of the platform, the full-height PSDs are not feasible. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Baychester Avenue Station is an embankment station with two side platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. The canopies cover only 40% of the platform length. There are columns located only at the canopies, set against the back wall of the platform. The platform widths are approximately 13'-0" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs are not feasible due to the lack of overhead structure at 60% of the station platform length. Full height PSDs require a top connection to brace against wind load.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting. At portions of platforms without roof, a custom-designed CCTV camera will need to be developed to be integrated into the APG housing.

Equipment Room

The equipment room can be located at the southern end of the northbound platform station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges are original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would at a minimum be required for the installation of an APG system.

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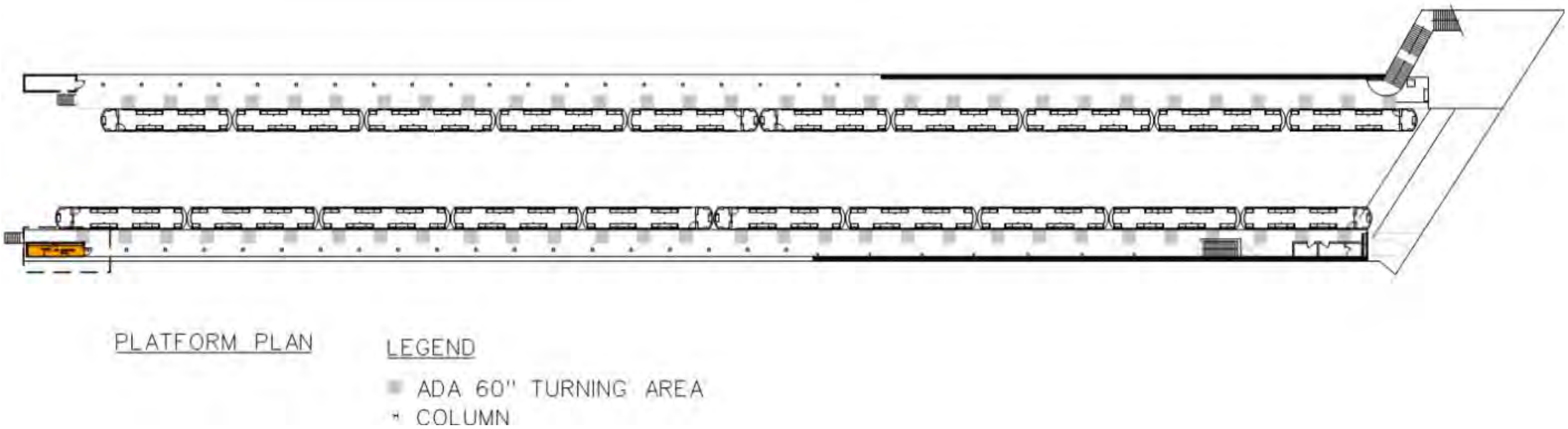

Figure 1 – Overall Station Plan
Baychester Avenue

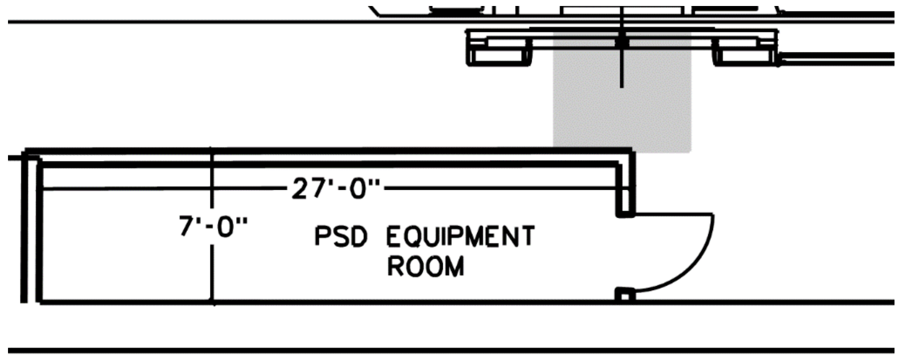

Figure 2 *– PSD Equipment Room 1 Detail*
Baychester Avenue Station

Figure 3 *– Typical platform view*
Baychester Avenue Station

Platform obstructions within 5' of edge:

- None

Lighting:

Existing lighting: At the canopy there are linear florescent fixtures mounted parallel to the platform edge. Beyond the canopy are individual point source fixtures mounted at the back of the platform. Depending on the specific APG design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. An analysis of electrical reserve service could not be performed due to inaccessibility during survey. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Baychester Avenue
Peak Demand Load from ConEd Report, (kW)	39.2
Apparent Power (kVA)	49.8
Station Peak Demand Load, Max Current, (A)	138.2
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	296
Station Service Power Capacity, (Main SB or SG Rating), (A)	400 (Estimated)
Service Spare Capacity, (A)	104
Is Electrical Service Adequate?	**Yes**
Notes	This analysis is for **Normal service**. Service rating is based on field survey photos and it is safe to assume 400A Service equipment. Only (1) meter readings for Normal service provided. The station Reserve Service was NOT accessible during field survey. (No meter reading for Reserve Service provided). 1 Line diagram provided is for Reserve Service and is not applicable to Normal Service.

***Table 1**. Normal Service Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.1M to install APGs (See Appendix E).

1.53 – MR 444 | Gun Hill Road Station

Summary: *Gun Hill Road Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the north end of the northbound platform as the existing width is 5'-8" (see figure 1)..*

Description

The Gun Hill Road Station is an embankment station with two side platforms. The platform structures are cast in place concrete. The platforms are straight with one row of columns along the back wall. The platforms widths are approximately 13'-0" throughout, with the exception of the north end under the mezzanine where both platform widths are reduced to 5'-8". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

Figure 1 *– Area of Non-compliant egress width*
Gun Hill Road Station

1.54 – MR 445 | Pelham Parkway Station

Summary: *Pelham Parkway Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the center of each platform as the existing width is 4'-4" (see figure 1).*

Description

The Pelham Parkway Station is a below ground station with two center / island platforms. Normal train service utilizes only the local (outer) side of each island platform. The platform structures are cast-in-place concrete. The platforms are straight with one row of columns at the center. The width of the platforms varies from approximately 14'-10" to 16'-10". At the center of the platforms, stairs and electrical rooms are constructed at 4'-4" from the outside platform edge (normal service platform) and 3'-4" from the inside platform edge. Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

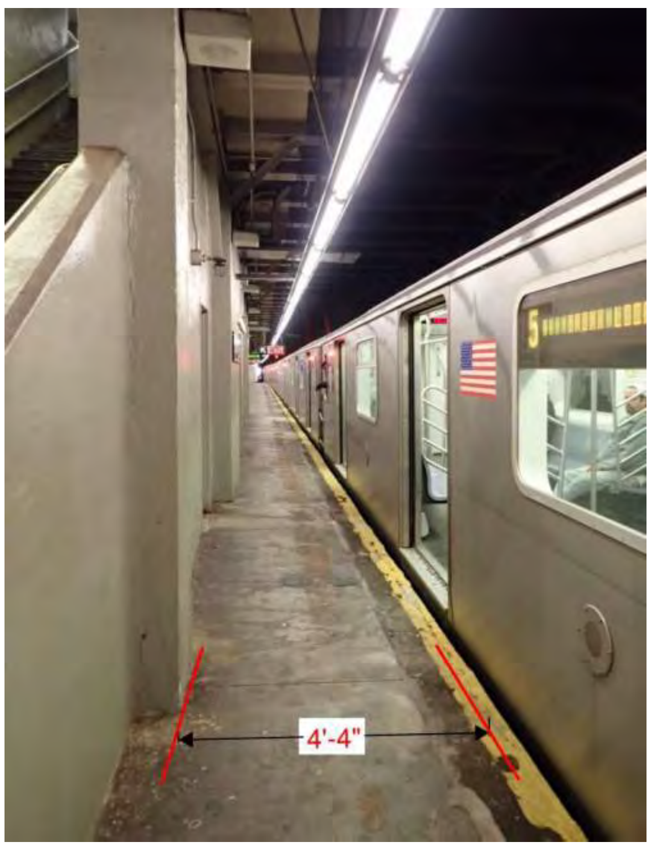

Figure 1 – *Area of Non-compliant egress width*
Pelham Parkway Station

1.55 – MR 446 | Morris Park Station

Summary: *Morris Park Station is feasible for APGs only. Due to a lack of overhead structure at much of the platform, the full-height PSDs are not feasible. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Morris Park Station is an open cut station with two straight side platforms. The platform structures are cast in place concrete. There are no columns throughout the platforms. The platform widths are approximately 13'-0" throughout. Ceiling heights measure no less than 7'-6" at the canopy. The canopy covers only 70% of the platform length. See figure 1 & 2 for reference.

Full Height PSDs: Full height PSDs are not feasible due to the lack of overhead structure at 30% of the station platform length. Full height PSDs require a top connection to brace against wind load.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting. At portions of platforms without roof, a custom-designed CCTV camera will need to be developed to be integrated into the APG housing.

Equipment Room

The equipment room can be located at the southern end of the northbound platform station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges are original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would at a minimum be required for the installation of an APG system.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for '5' Line Stations
(Morris Park Station)

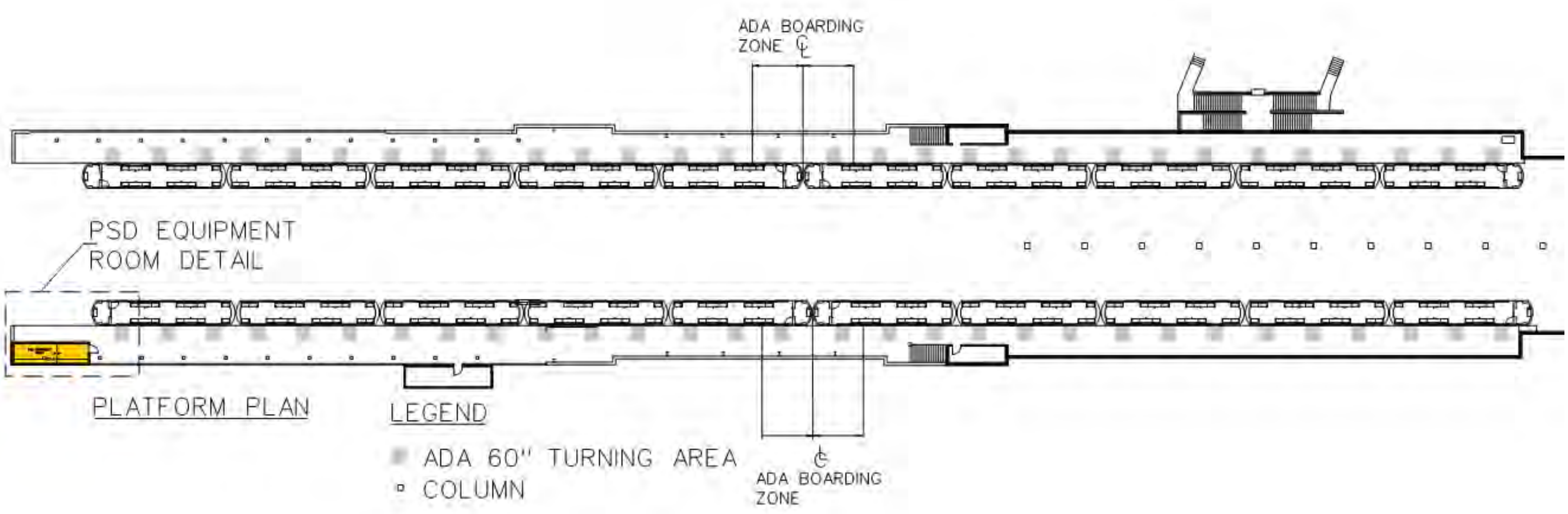

Figure 1 *– Overall Station Plan*
Morris Park Station

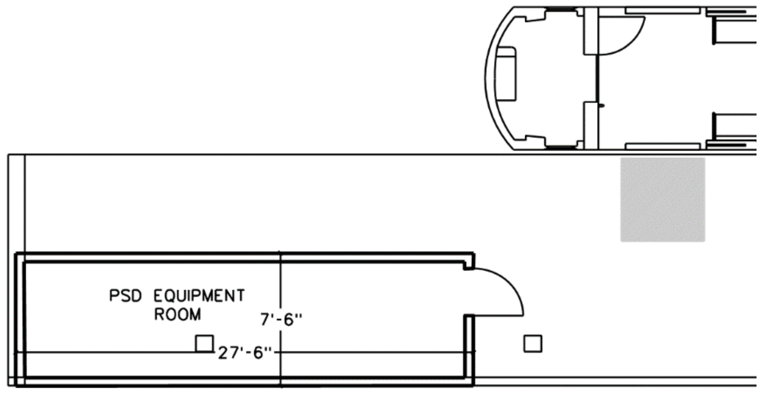

Figure 2 *– PSD Equipment Room Detail*
Morris Park Station

Platform obstructions within 5' of edge:

- None

Lighting:

Existing lighting: At the canopy there are linear florescent fixtures mounted parallel to the platform edge. Beyond the canopy are individual point source fixtures mounted at the back of the platform. Depending on the specific APG design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate electrical capacity to support the implementation of an APG system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 & 2 see the Power Capacity Analysis for this station.

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Station Power Capacity Analysis (Normal)

Station Name	Morris Park
Peak Demand Load from ConEd Report, (kW)	41.6
Apparent Power (kVA)	52.0
Station Peak Demand Load, Max Current, (A)	144.4
Maximum Amount of Doors	60.0
PSD Total Load Including All Misc. Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	303
Station Service Power Capacity, (A)	500
Service Spare Capacity, (A)	197
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 500A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve)

Station Name	Morris Park
Peak Demand Load from ConEd Report, (kW)	0.0
Apparent Power (kVA)	0.0
Station Peak Demand Load, Max Current, (A)	0.0
Maximum Amount of Doors	60.0
PSD Total Load Including All Misc. Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	158
Station Service Power Capacity, (A)	500
Service Spare Capacity, (A)	342
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 500A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Reserve service has **Zero (0)** KW Peak demand reading.

Table 2. Power Capacity Analysis

Figure 3 *– Typical platform view*
Morris Park Station

Historic Restrictions:
The Morris Park station is a historically designated property. As such, design will require review by the New York State Historic Preservation Office.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.2M to install APGs (See Appendix E).

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*
>
> - *a. Column location in relation to the platform edge*
> - *b. Platform edge clearance adjacent to stairs and other impediments*
> - *c. Impacts to ADA path of travel and boarding areas*
> - *d. Conflicts of PSD/APG/RPSDs with Signals cables*
> - *e. Sufficient platform width*
> - *f. Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*
>
> - *a. Structural capacity of platforms to accept PSD/APG/RPSDs*
> - *b. Feasibility & location for PSD/APG/RPSDs equipment room*
> - *c. Confirmation of adequate power for PSD/APG/RPSDs*
> - *d. Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> - *e. Determination of communications requirements, availability and cost*
> - *f. Determination of gap detection and entrapment avoidance technology requirements*
> - *g. Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
    - Double the amount of motors as PSDs (each motor operating a single leaf).
    - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
    - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
    - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

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If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

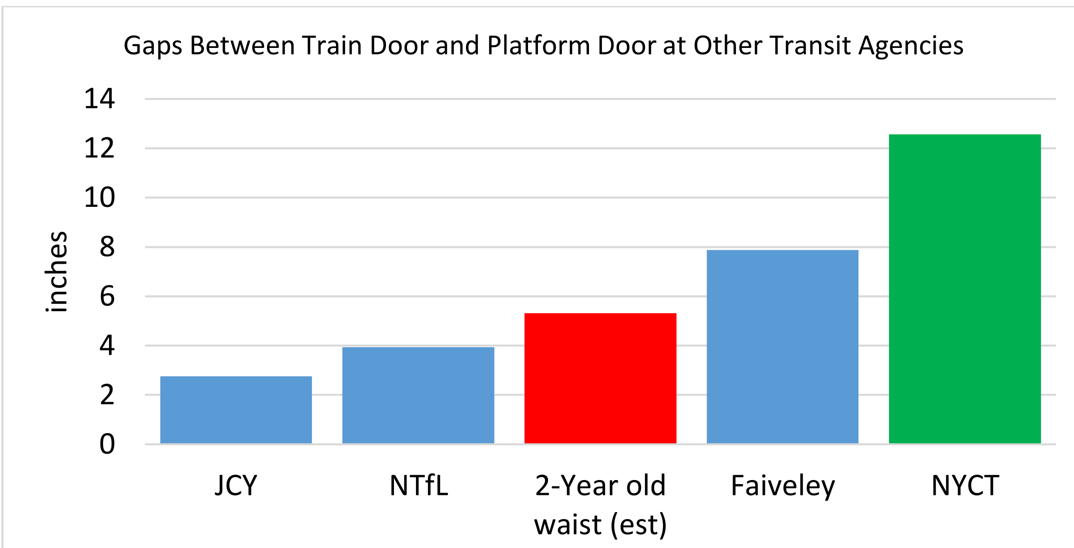


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

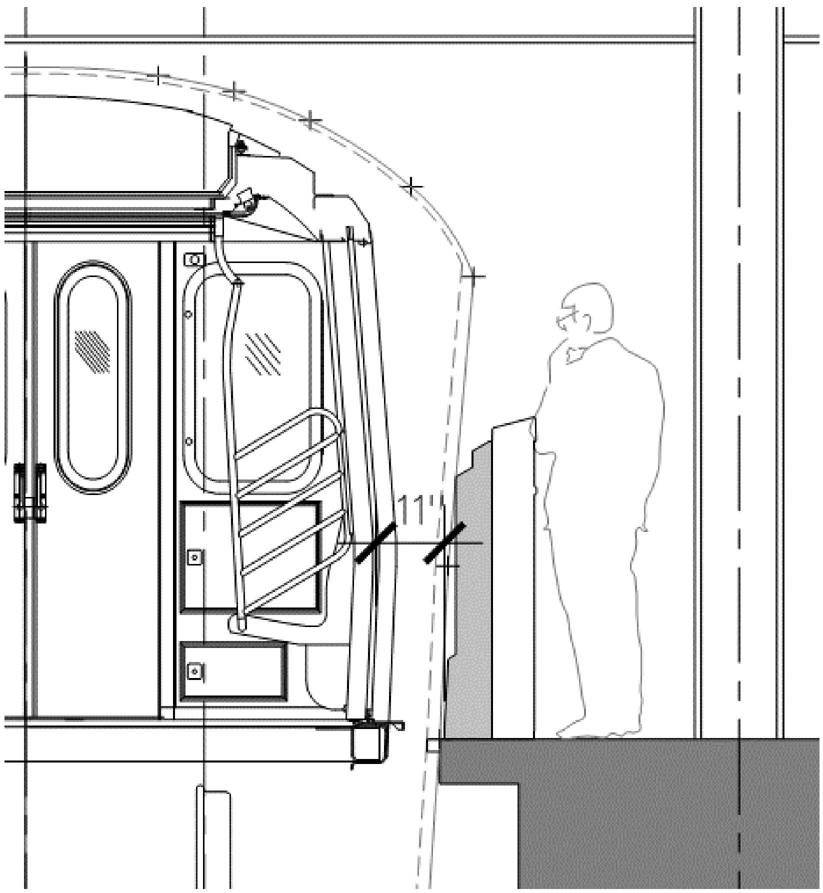


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber “bumpers” on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6” into the line equipment envelope. This would leave a 5” gap between the platform and car doors allowing approximately 2” of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5" by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor's window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor's window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **bold/underline**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	**PSD System 1**	**PSD System 2**	**PSD System 3**
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are "existing" as defined by code. All the rolling stock is also to be considered "existing" under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60" radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36" of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

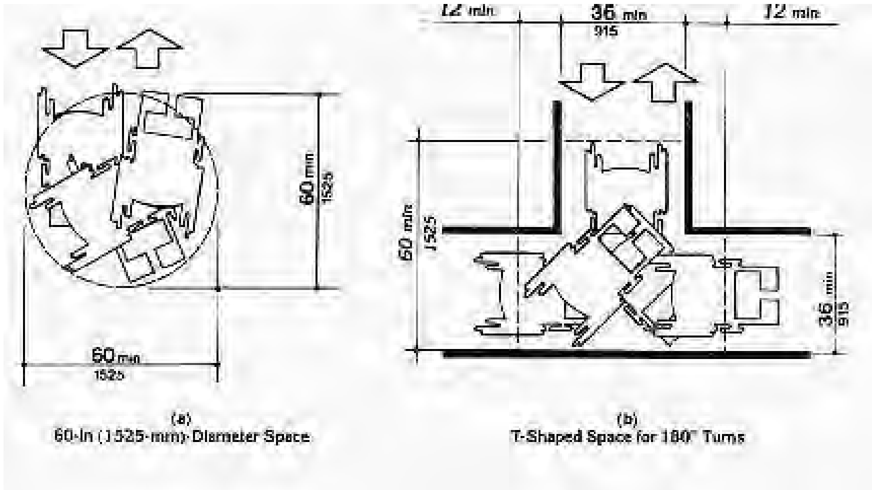
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

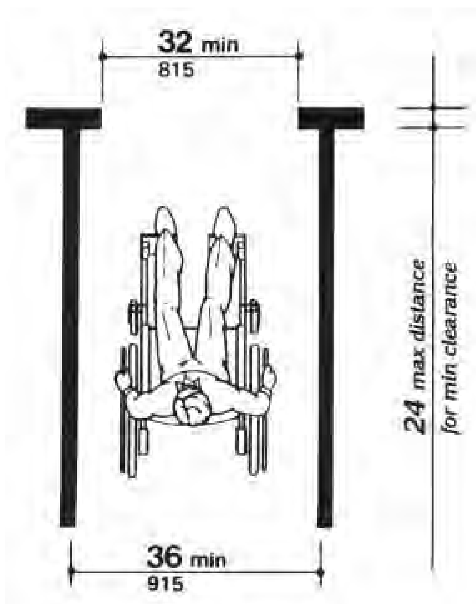


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

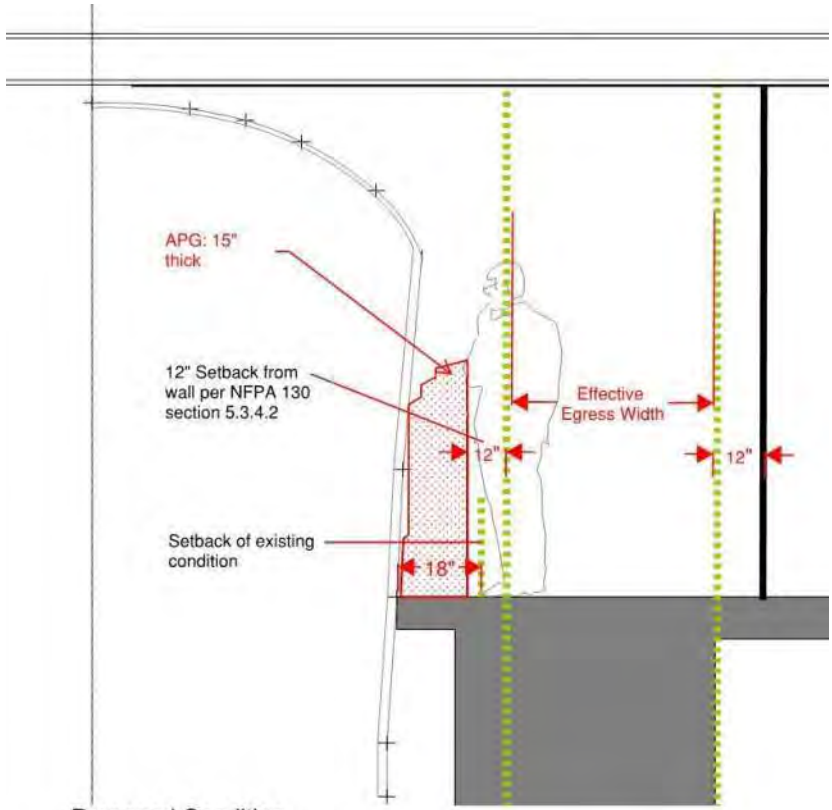
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15” of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

Table of Contents

Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

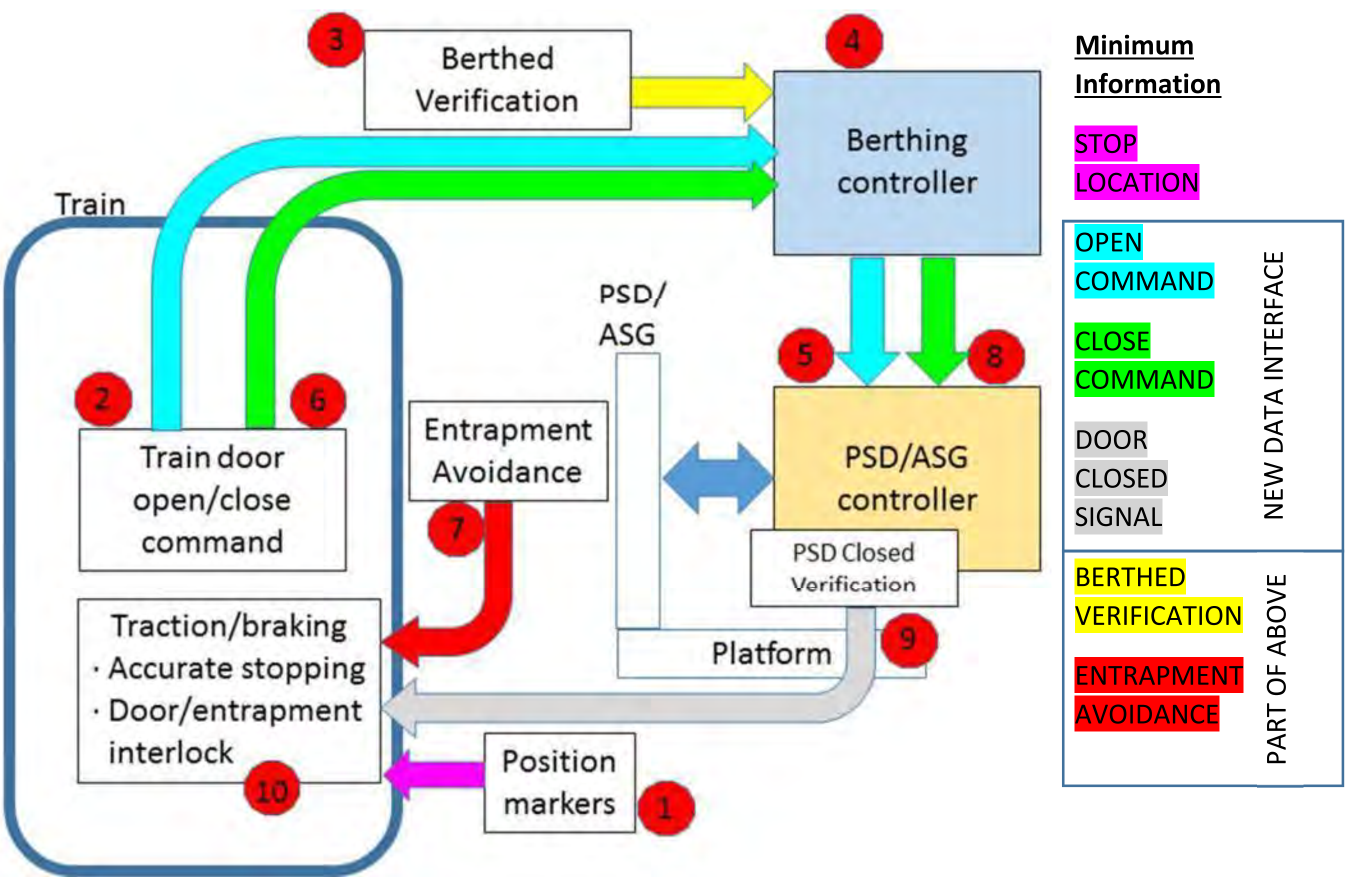
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

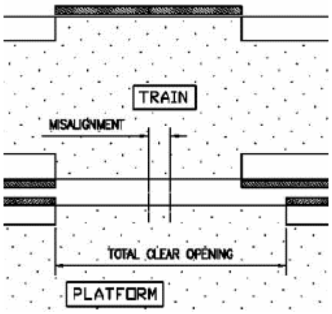
C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5” clear opening, a design for NY should meet the ADA Accessibility Guideline of 36”.

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a ‘distance totem’ which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy’s COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

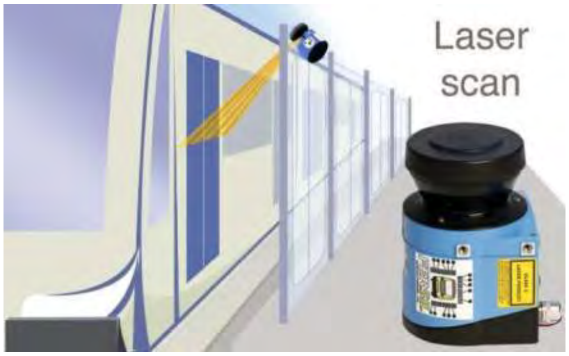
The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically

If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.



For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4'-0"). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

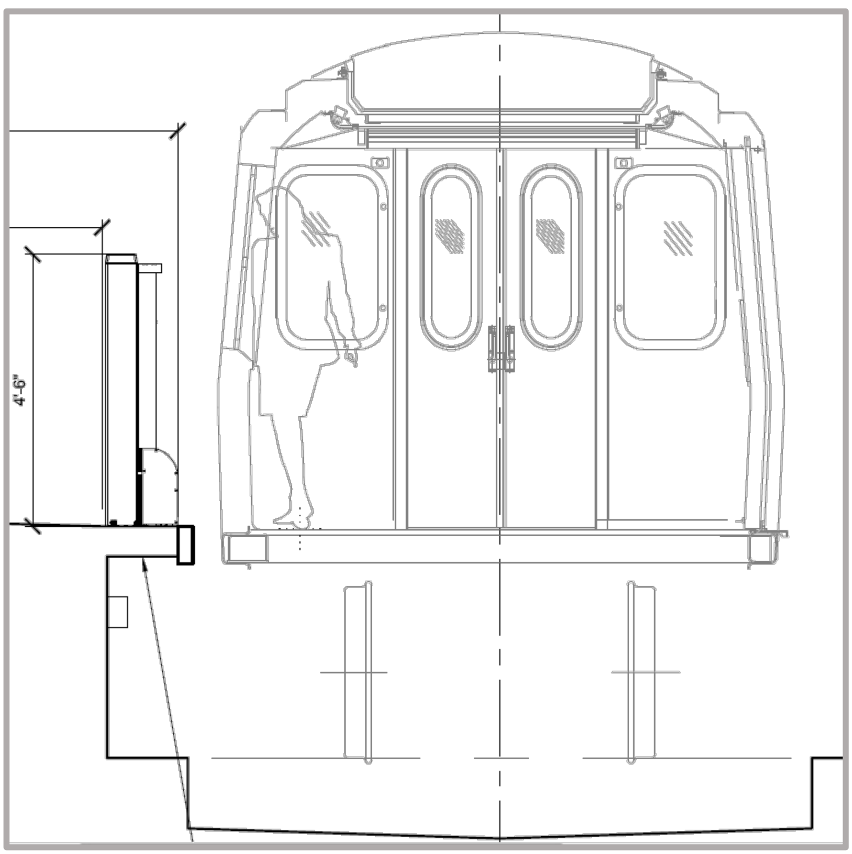


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 $lbs/ft.^2$ (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

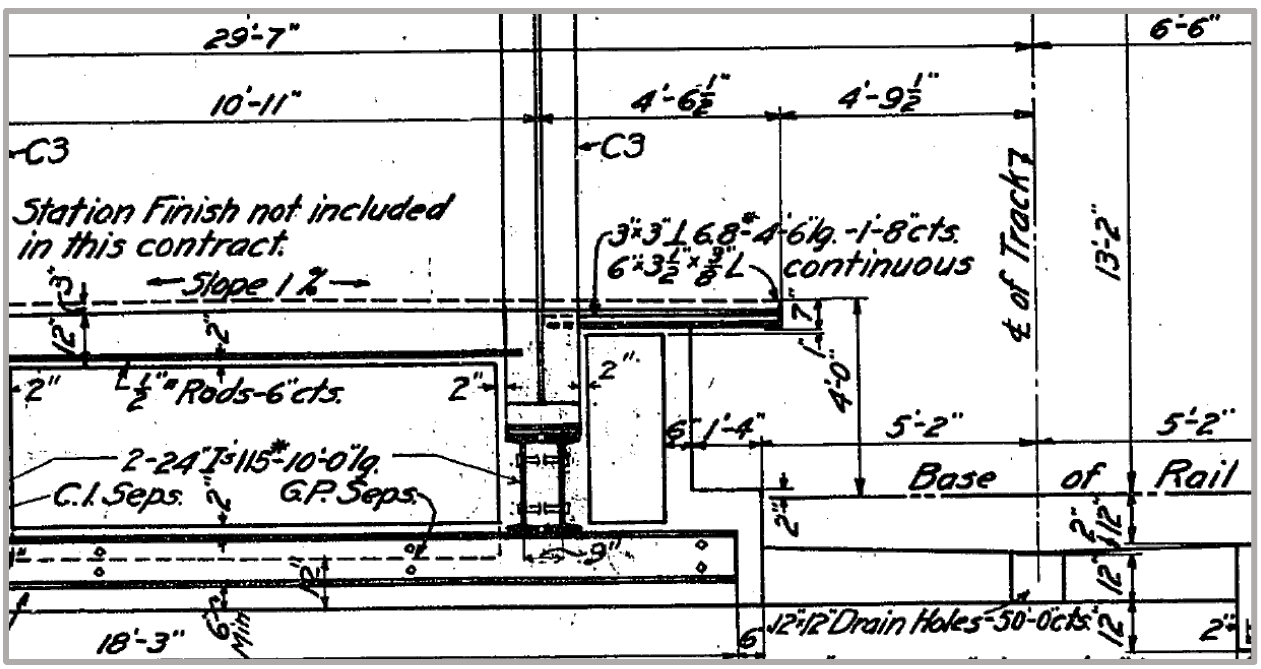


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

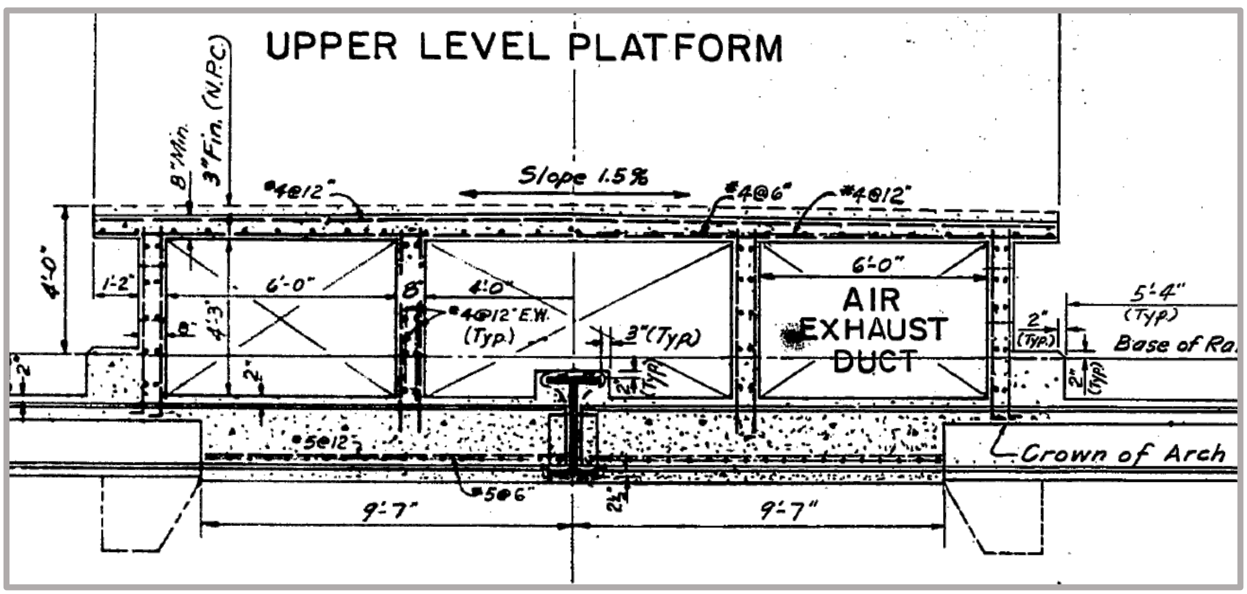


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

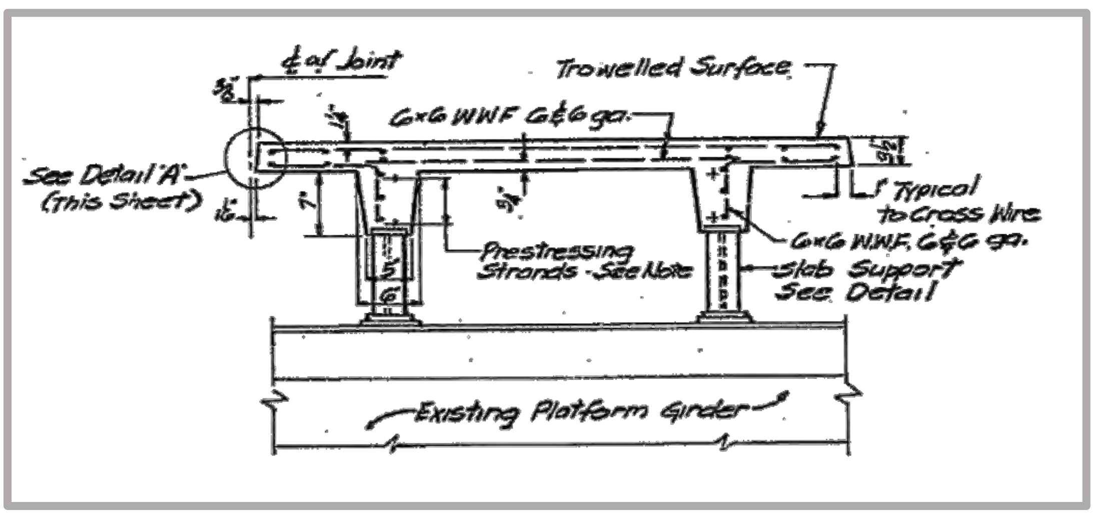


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

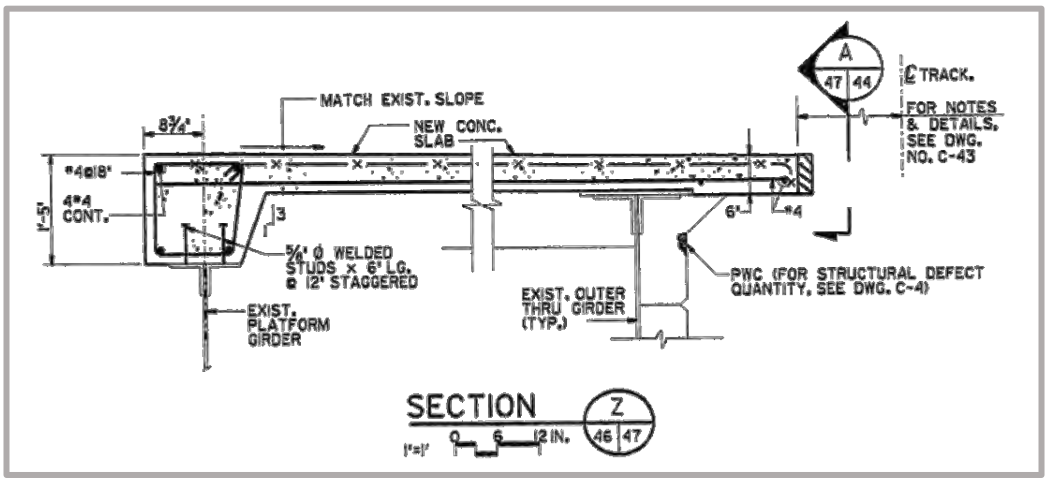


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2'-9"), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

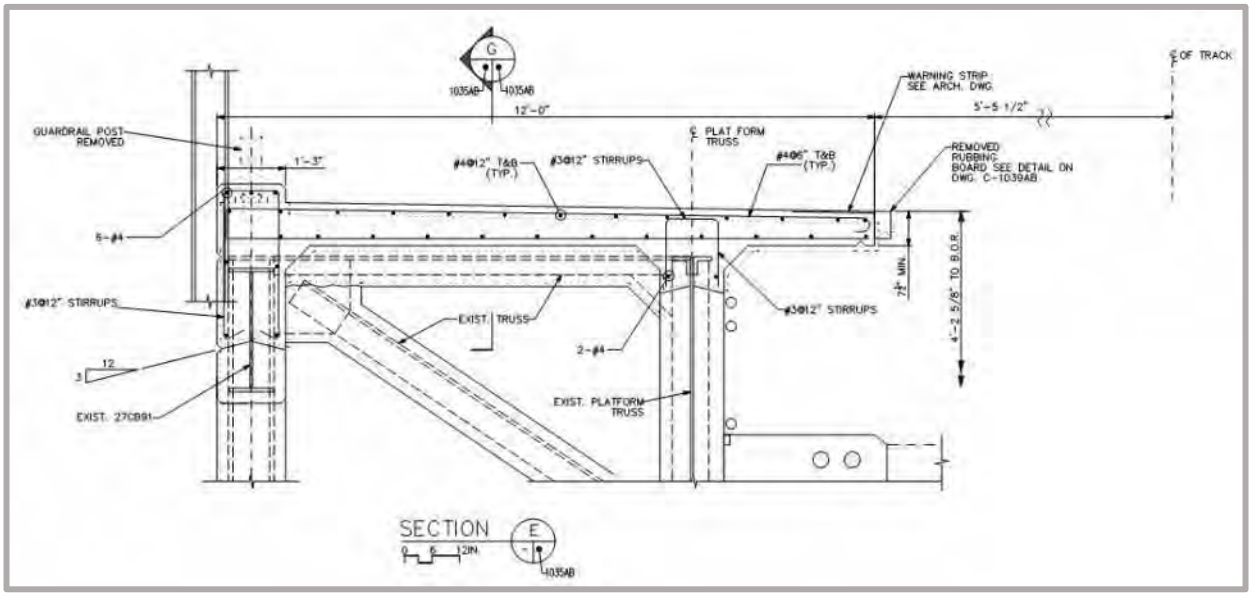


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3" thick structural slab with an approximately 3" thick topping slab. If the topping slab is fully removed, a 6" thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6" thick slab will be sufficient for a cantilever length of up to approximately 3'-0", greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6" structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6" minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

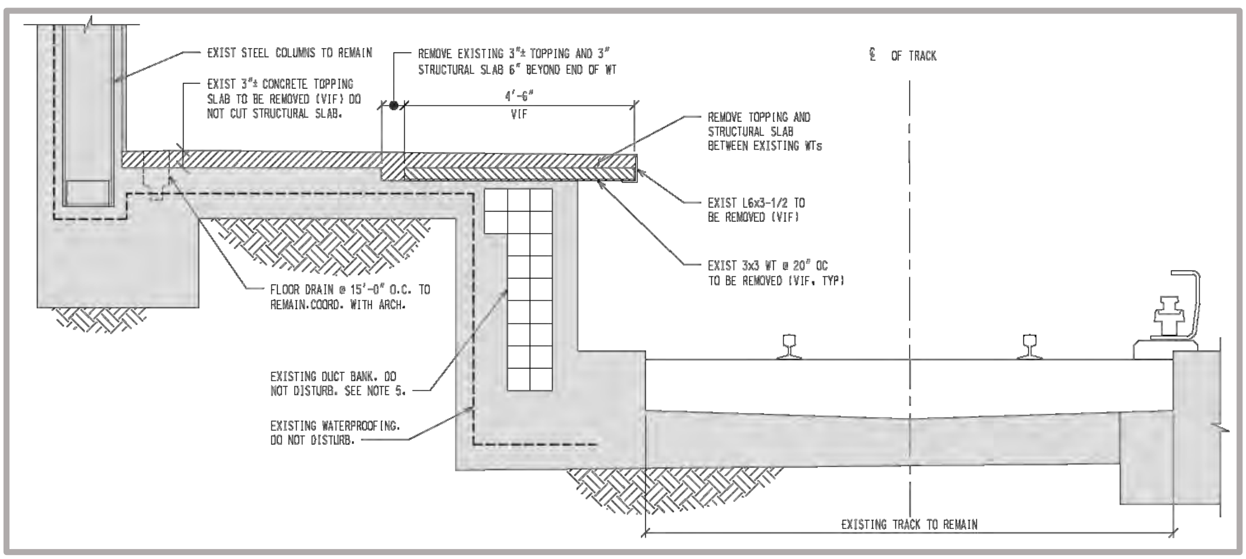


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

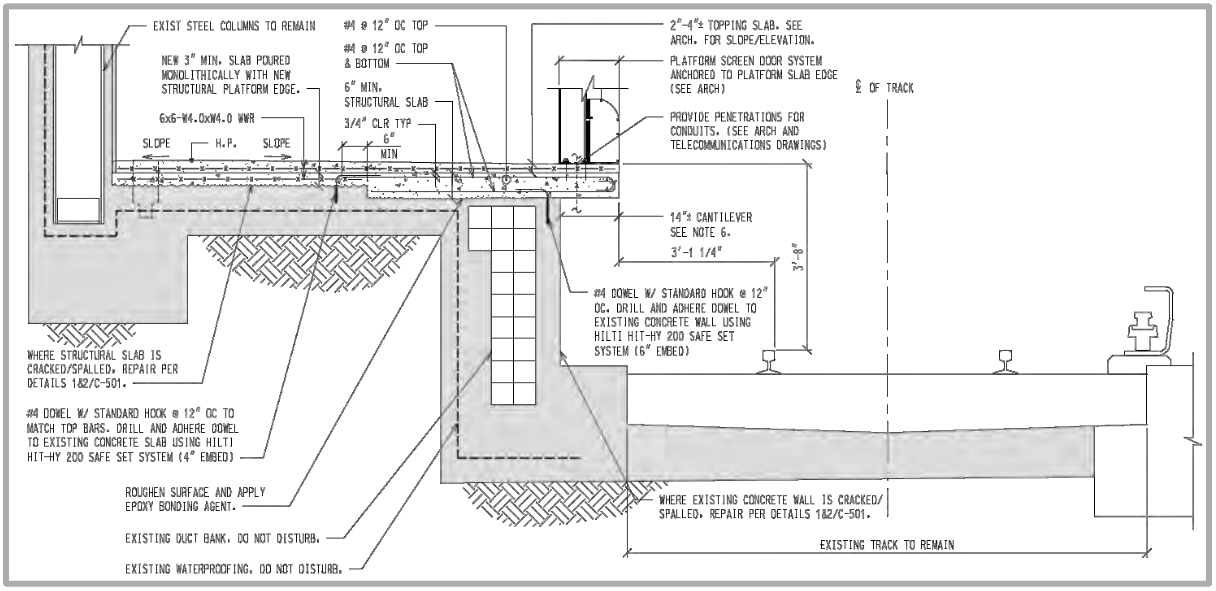


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

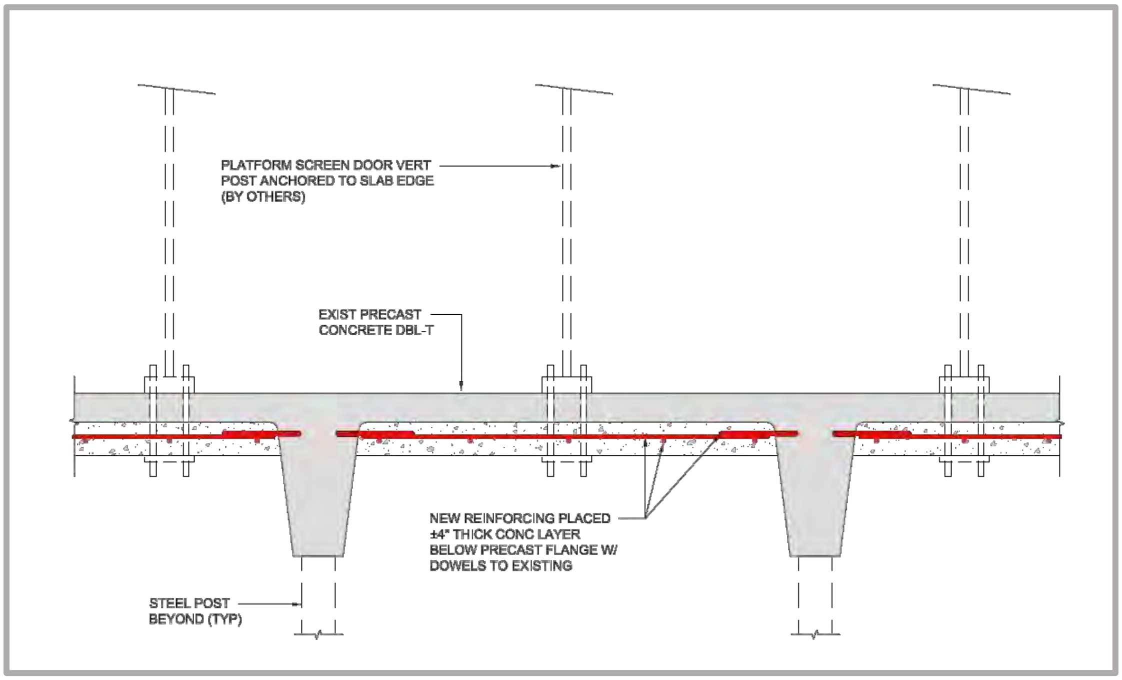


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5’ – 11” of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis

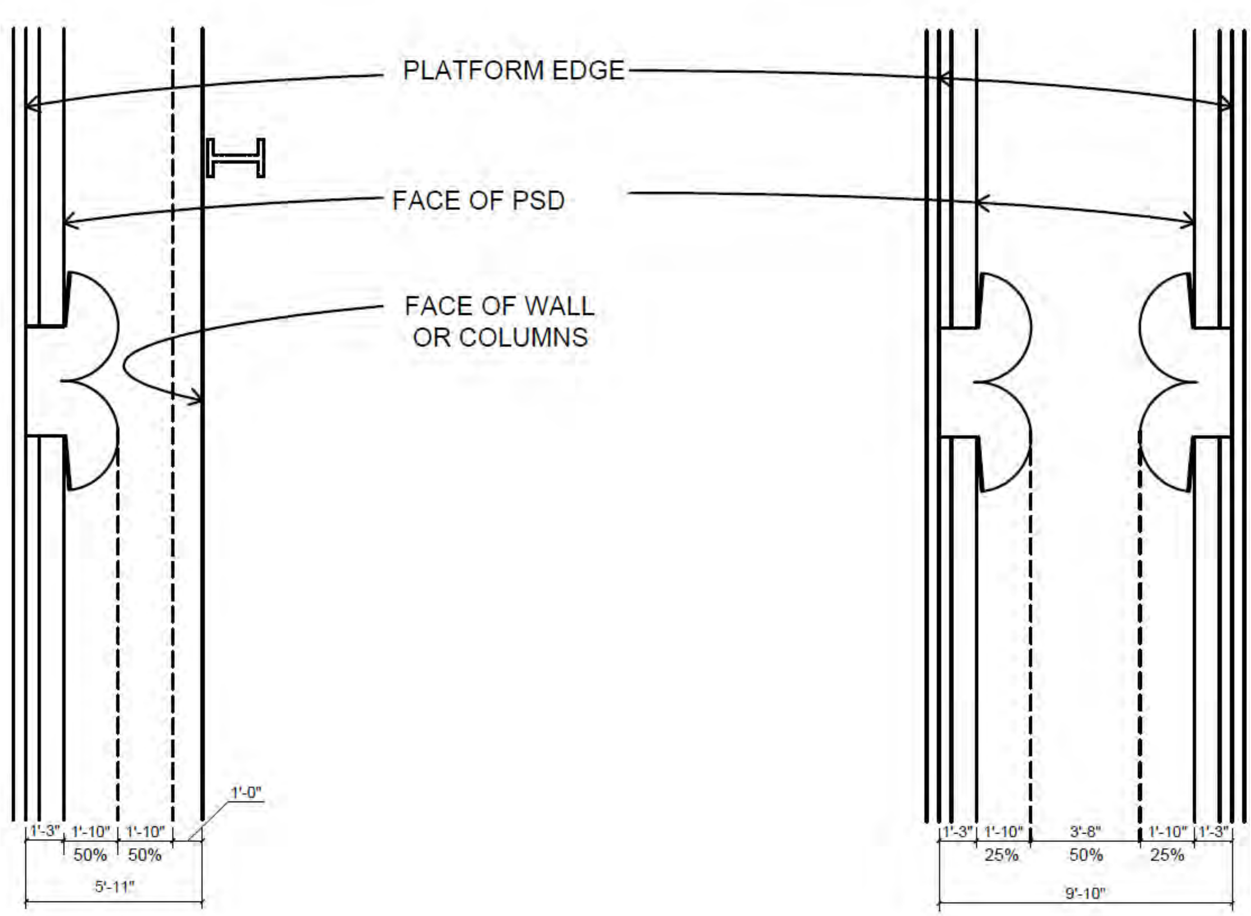


FIGURE 1: SIDE PLATFORM **FIGURE 2: CENTER PLATFORM**

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

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MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the	9	$ 63,500 per month [Year 01]	$ 571,500		
	platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance	12	$ 83,590 per month [Year 02]	$ 1,003,080		
	since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment.	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
		12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663		

ITEM NO.	DESCRIPTION		QUANTITY	RATE	
7	Labor Bill Rate (per hour)		Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)		Year 2	$ 248 per hour *	
			Year 3	$ 257 per hour *	
		Optional :	Year 4	$ 268 per hour *	
		Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

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ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations
ESTIMATE DATE:	August 8, 2019

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VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

MTA/NYCT

August 8, 2019

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.2 *APGs / PSDs will provide 29 emergency egress doors with push bars per platform*
1.3 *Each platform edge will have 40 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 It is assumed that each train has 10 cars on this line
2.2 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.3 In respect of the PSD option, only platforms that have not been upgraded in the recent past will require platform edge replacement.
2.4 There are no special security requirements made necessary by installation of the APG system
2.5 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.6 This estimate does not provide for the replacement of Platform Edge Lighting
2.7 Premium cost for night time work is considered 50% of total labor cost

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

MTA/NYCT

August 8, 2019

BASIS OF ESTIMATE

3.0 ***Exclusions - Costs not included in the estimate:***

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems

3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length

3.4 Costs associated with NYCT State Of Good Repair improvements to the station

3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.

3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs

3.7 Escalation Cost is not included; Anticipate at 5% per annum.

3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.

3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium

3.10 NYCT project cost is not included

3.11 GO and flagging cost is not included

3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or "soft" costs:***

4.1 Design and Construction Contingency

4.2 Contractor O & P

4.3 Insurance

4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 Given the limited time available, no drawings were developed to support this estimate.

MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

August 8, 2019

	ORDER OF MAGNITUDE COSTS		MRN 354	MRN 395	MRN 412	MRN 414	MRN 443	MRN 446
	DESCRIPTION		STERLING STREET	103RD STREET	FULTON STREET	BOWLING GREEN	BAYCHESTER AVENUE	MORRIS PARK
1	AUTOMATIC PLATFORM GATES (APG'S)		$14,178,075	$14,643,536	$14,569,859	$14,473,186	$14,382,642	$14,401,908
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$14,178,075	$14,643,536	$14,569,859	$14,473,186	$14,382,642	$14,401,908
4	GENERAL REQUIREMENTS	15.00%	$2,126,711	$2,196,530	$2,185,479	$2,170,978	$2,157,396	$2,160,286
	SUB-TOTAL:		$16,304,787	$16,840,067	$16,755,338	$16,644,163	$16,540,039	$16,562,194
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,076,197	$4,210,017	$4,188,835	$4,161,041	$4,135,010	$4,140,549
	SUB-TOTAL:		$20,380,983	$21,050,083	$20,944,173	$20,805,204	$20,675,048	$20,702,743
6	OVERHEAD & PROFIT	15.00%	$3,057,147	$3,157,513	$3,141,626	$3,120,781	$3,101,257	$3,105,411
	SUB-TOTAL:		$23,438,131	$24,207,596	$24,085,799	$23,925,985	$23,776,306	$23,808,154
7	BONDS & INSURANCE	3.75%	$878,930	$907,785	$903,217	$897,224	$891,611	$892,806
	SUB-TOTAL:		$24,317,061	$25,115,381	$24,989,016	$24,823,209	$24,667,917	$24,700,960
	SUBTOTAL CONSTRUCTION COST W/O ACM		$24,317,061	$25,115,381	$24,989,016	$24,823,209	$24,667,917	$24,700,960
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		$24,317,061	$25,115,381	$24,989,016	$24,823,209	$24,667,917	$24,700,960
10	DESIGN CONSULTANT FEES	10.00%	$2,431,706	$2,511,538	$2,498,902	$2,482,321	$2,466,792	$2,470,096
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		$26,748,767	$27,626,919	$27,487,918	$27,305,530	$27,134,709	$27,171,056
	ADD ALTERNATIVES							
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		$3,534,070	$3,645,891	$3,777,105	$3,429,795	$0	$0
	Add for Markups (as above)	88.66%	3,133,408	3,232,552	3,348,890	3,040,955	0	0
	SUB-TOTAL PSD ALTERNATIVE		$6,667,478	$6,878,443	$7,125,995	$6,470,750	$0	$0
	TOTAL PROJECT COST (PSD OPTION)		$33,416,245	$34,505,362	$34,613,912	$33,776,281	$0	$0

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : STERLING STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	507	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	507	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,014**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,014	LF	7	7,098
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,070	SF	12	60,840
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	102	CY	2,500	255,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,016	EA	25	25,400
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,016	EA	25	25,400
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,014	LF	95	96,330
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,014	LF	15	15,210
26	Remove existing platform tiles	1,014	LF	12	12,168
27	Sawcut existing topping concrete at perimeter of removal area	1,014	LF	5	5,070
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,084	SF	8	48,672
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-0" wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,014	SF	15	15,210

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : STERLING STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,088	SF	750	1,566,000
61	Spare Parts - Approx. 10% of Material Cost	1	LS	190,020	190,020
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : STERLING STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,014	LF	60	60,840
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : STERLING STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,271,864	3,271,864
112					
113	TOTAL PSD WORK:				$ 14,178,075
115					
116	**ADD ALTERNATIVE**				
117					
118	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
119					
120	**ADD**				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,446	SF	750	3,334,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	350,177	350,177
127	Structural framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	67,547
129	L6x6x1/2 continuous angle	7	TONS	17,500	130,603
130	Drilling and bolting - 4 bolts at each connection	406	EA	216	87,610
131	Platform Edge Repair				
132	Remove concrete platform edge	1,014	LF	27	27,378
133	Platform edge repair	1,014	LF	109	110,526
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	496	EA	10	4,960
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : STERLING STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,088)	SF	750	(1,566,000)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	190,020	(190,020)
152	Platform Edge Reconstruction work	(1)	LS	481,840	(481,840)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,014)	LF	30	(30,420)
155					
156	Allow loss of production to work at night say 50%	1	LS	815,555	815,555
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				**$ 3,534,070**

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : 103RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	550	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	550	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,100**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,100	LF	7	7,700
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,500	SF	12	66,000
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	111	CY	2,500	277,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,102	EA	25	27,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,102	EA	25	27,550
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,100	LF	95	104,500
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,100	LF	15	16,500
26	Remove existing platform tiles	1,100	LF	12	13,200
27	Sawcut existing topping concrete at perimeter of removal area	1,100	LF	5	5,500
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,600	SF	8	52,800
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10'-0" wide strip	320	SF	8	2,560
30	New Work				
31	New concrete topping to match existing	1,100	SF	15	16,500

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : 103RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	320	SF	15	4,800
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,475	SF	750	1,856,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	207,435	207,435
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : 103RD STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,100	LF	60	66,000
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : 103RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,379,278	3,379,278
112					
113	TOTAL PSD WORK:				$ 14,643,536
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,134	SF	750	3,850,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	381,137	381,137
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	73,165
129	L6x6x1/2 continuous angle	8	TONS	17,500	141,680
130	Drilling and bolting - 4 bolts at each connection	440	EA	216	95,040
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : 103RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,475)	SF	750	(1,856,250)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	207,435	(207,435)
152	Platform Edge Reconstruction work	(1)	LS	513,800	(513,800)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,100)	LF	30	(33,000)
155					
156	Allow loss of production to work at night say 50%	1	LS	841,359	841,359
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 3,645,891

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : FULTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	538	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	538	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,077**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,077	LF	7	7,538
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,384	SF	12	64,610
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	109	CY	2,500	272,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,079	EA	25	26,971
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,079	EA	25	26,971
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,077	LF	95	102,300
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,077	LF	15	16,153
26	Remove existing platform tiles	1,077	LF	12	12,922
27	Sawcut existing topping concrete at perimeter of removal area	1,077	LF	5	5,384
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,461	SF	8	51,688
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10' wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,077	SF	15	16,153

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : FULTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,371	SF	750	1,778,085
61	Spare Parts - Approx. 10% of Material Cost	1	LS	202,745	202,745
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : FULTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,077	LF	60	64,610
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	400	LF	60	24,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	450	LF	60	27,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : FULTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,362,275	3,362,275
112					
113	TOTAL PSD WORK:				$ 14,569,859
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,948	SF	750	3,711,315
126	Spare Parts - Approx. 10% of Material Cost	1	LS	372,799	372,799
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	71,652
129	L6x6x1/2 continuous angle	8	TONS	17,500	138,697
130	Drilling and bolting - 4 bolts at each connection	431	EA	216	93,039
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	40	HRS	162	6,480
137	Remove signal cables	300	LF	40	12,000
138	Remove conduit; Assuming 1"	300	LF	55	16,500
139	Install conduit in new position	300	LF	110	33,000
140	Install replacement cable; assumed single cable #12	300	LF	125	37,500
141	Re-commission / testing as required	1	EA	12,500	12,500
142	Engineering / Shop Drawings / Etc.	1	EA	7,500	7,500
143	Premium Time	785	HRS	49	38,151
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : FULTON STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,371)	SF	750	(1,778,085)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	202,745	(202,745)
152	Platform Edge Reconstruction work	(1)	LS	506,252	(506,252)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,077)	LF	30	(32,305)
155					
156	Allow loss of production to work at night say 50%	1	LS	871,640	871,640
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 3,777,105

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : BOWLING GREEN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	522	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	516	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,038**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,038	LF	7	7,266
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,190	SF	12	62,280
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	105	CY	2,500	262,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,040	EA	25	26,000
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,040	EA	25	26,000
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,038	LF	95	98,610
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,038	LF	15	15,570
26	Remove existing platform tiles	1,038	LF	12	12,456
27	Sawcut existing topping concrete at perimeter of removal area	1,038	LF	5	5,190
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,228	SF	8	49,824
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10' wide strip	560	SF	8	4,480
30	New Work				
31	New concrete topping to match existing	1,038	SF	15	15,570

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : BOWLING GREEN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	560	SF	15	8,400
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Platform column restructuring**				
37	Demolition				
38	Install, maintain and remove temporary support	2	LS	15,000	30,000
39	Breakout existing platform slab for new column	2	LS	5,000	10,000
40	New Work				
41	Excavate for foundation for new column	2	EA	1,500	3,000
42	Foundation for new column	2	EA	5,000	10,000
43	New structural steel column	2	EA	20,000	40,000
44	Extend and repair beams above	2	LS	5,000	10,000
45	Grillage	2	EA	10,000	20,000
46					
47	**Equipment Room [7'-0" x 27'-6"]**				
48	Build off existing platform slab		Note		
49	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
50	CMU Wall for equipment room	415	SF	45	18,675
51	Vertical connections with existing structure	20	LF	25	500
52	Roof for equipment room	193	SF	30	5,775
53	Fire rated door including frame & hardware	1	EA	2,500	2,500
54	Exterior wall finish				
55	Ceramic Tiling to match existing	415	SF	40	16,600
56	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
57	Concrete cove to match existing	42	LF	20	830
58	Interior Wall Finish - Paint	690	SF	5	3,450
59	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
60	Allow for 4" thick concrete pads for equipment	48	SF	20	963
61	Allowance for Mechanical Scope	1	LS	40,000	40,000
62	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
63	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
64	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
65					
66	**Automatic Platform Gates [APGs] - 4'-6" High**				
67	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
68	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
69	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
70	Platform End Gates (PEGs)	4	EA	13,000	52,000
71	Fixed Panels including framing and support; 4'-6" High	2,196	SF	750	1,647,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : BOWLING GREEN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
72	Spare Parts - Approx. 10% of Material Cost	1	LS	194,880	194,880
73	Testing and commissioning	800	HRS	160	127,944
74	Product Warranty	1	LS	1,000,000	1,000,000
75	Allowance for Braille Signage	60	EA	2,500	150,000
76					
77	**Electrical**				
78	Electrical Upgrades				
79	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
80	Power and Lighting				
81	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
82	Allow for conduit / cable runs for power and communications under platform edge	1,038	LF	60	62,280
83	PSD Connections	1	LS	75,000	75,000
84	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
85	Power to PSD Rooms from EDR [Conduit & Cable]	100	LF	60	6,000
86	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
87	No allowance for new lighting as if APG's are used		Note		EXCL.
88	Grounding				
89	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
90	MISC				
91	Testing and commissioning	1	EA	30,000	30,000
92	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
93					
94	**Communications**				
95	FA System				
96	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
97	CCTV coverage				
98	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
99	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
100	Berthing Technology Sensors				
101	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
102	Train Door Detection System				
103	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
104	Entrapment concerns				
105	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
106	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
107	Engineering and Testing	1,000	Hrs	160	159,930

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : BOWLING GREEN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
108	Centralized monitoring/control				
109	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
110	MISC				
111	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
112	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
113	Site Survey and Inspections	1	LS	100,000	100,000
114	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
115	Furnish Test Equipment allowance	1	LS	500,000	500,000
116	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
117					
118	Training				
119	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
120					
121	Out of hours Work				
122	Allow loss of production to work at night say 50%	1	LS	3,339,966	3,339,966
123					
124	TOTAL PSD WORK:				$ 14,473,186
126					
127	ADD ALTERNATIVE				
128					
129	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
130					
131	ADD				
132	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
133	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
134	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
135	Platform End Gates (PEGs)	4	EA	18,000	72,000
136	Fixed Panels including framing and support; Assuming 8'-0" high	4,638	SF	750	3,478,275
137	Spare Parts - Approx. 10% of Material Cost	1	LS	358,817	358,817
138	Structual framing / bracing				
139	HSS4x4x1/2 hanger	4	TONS	17,500	69,115
140	L6x6x1/2 continuous angle	8	TONS	17,500	133,694
141	Drilling and bolting - 4 bolts at each connection	415	EA	216	89,683
142	Platform Edge Repair				
143	Remove concrete platform edge				Previously done
144	Platform edge repair				Previously done

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : BOWLING GREEN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
146	Signal Work [Each 300' length is associated with one signal light]				
147	Disconnects				Not Applicable
148	Remove signal cables				Not Applicable
149	Remove conduit; Assuming 1"				Not Applicable
150	Install conduit in new position				Not Applicable
151	Install replacement cable; assumed single cable #12				Not Applicable
152	Re-commission / testing as required				Not Applicable
153	Engineering / Shop Drawings / Etc.				Not Applicable
154	Premium Time				Not Applicable
155					
156	**OMIT**				
157	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
158	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
159	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
160	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
161	Fixed Panels including framing and support; 4'-6" High	(2,196)	SF	750	(1,647,000)
162	Spare Parts - Approx. 10% of Material Cost	(1)	LS	194,880	(194,880)
163	Platform Edge Reconstruction work	(1)	LS	491,980	(491,980)
164	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
165	Conduit running under Platform Edge	(1,038)	LF	30	(31,140)
166					
167	Allow loss of production to work at night say 50%	1	LS	791,491	791,491
168					
169	**PREMIUM ASSOCIATED WITH PSD's**				**$ 3,429,795**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : BAYCHESTER AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	525	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	526	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,051**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,051	LF	7	7,355
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,253	SF	12	63,041
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	106	CY	2,500	265,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,053	EA	25	26,317
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,053	EA	25	26,317
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,051	LF	95	99,815
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,051	LF	15	15,760
26	Remove existing platform tiles	1,051	LF	12	12,608
27	Sawcut existing topping concrete at perimeter of removal area	1,051	LF	5	5,253
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,304	SF	8	50,433
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10' wide strip	520	SF	8	4,160
30	New Work				
31	New concrete topping to match existing	1,051	SF	15	15,760

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : BAYCHESTER AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	520	SF	15	7,800
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	34	LF	90	3,060
39	CMU Wall for equipment room	204	SF	45	9,180
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	204	SF	40	8,160
45	Mosaic Band to match existing - Assuming 8" high	34	LF	120	4,080
46	Concrete cove to match existing	34	LF	20	680
47	Interior Wall Finish - Paint	408	SF	5	2,040
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54	Allowance to patch existing wall and support it for extension to full height	1	LS	5,000	5,000
55					
56	**Automatic Platform Gates [APGs] - 4'-6" High**				
57	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
58	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
59	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
60	Platform End Gates (PEGs)	4	EA	13,000	52,000
61	Fixed Panels including framing and support; 4'-6" High	2,253	SF	750	1,689,795
62	Spare Parts - Approx. 10% of Material Cost	1	LS	197,448	197,448
63	Testing and commissioning	800	HRS	160	127,944
64	Product Warranty	1	LS	1,000,000	1,000,000
65	Allowance for Braille Signage	60	EA	2,500	150,000
66					
67	**Electrical**				
68	Electrical Upgrades				
69	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
70	Power and Lighting				
71	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : BAYCHESTER AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
72	Allow for conduit / cable runs for power and communications under platform edge	1,051	LF	60	63,041
73	PSD Connections	1	LS	75,000	75,000
74	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
75	Power to PSD Rooms from EDR [Conduit & Cable]	250	LF	60	15,000
76	Reserve power to PSD Room from EDR [Conduit & Cable]	300	LF	60	18,000
77	No allowance for new lighting as if APG's are used		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
97	Engineering and Testing	1,000	Hrs	160	159,930
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : BAYCHESTER AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	3,319,071	3,319,071
113					
114	TOTAL PSD WORK:				$ 14,382,642
116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)				Not Applicable
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform				Not Applicable
124	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
125	Platform End Gates (PEGs)				Not Applicable
126	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
127	Spare Parts - Approx. 10% of Material Cost				Not Applicable
128	Structural framing / bracing				
129	HSS4x4x1/2 hanger				Not Applicable
130	L6x6x1/2 continuous angle				Not Applicable
131	Drilling and bolting - 4 bolts at each connection				Not Applicable
132	Platform Edge Repair				
133	Remove concrete platform edge				Previously done
134	Platform edge repair				Previously done
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
136	Signal Work [Each 300' length is associated with one signal light]				
137	Disconnects				Not Applicable
138	Remove signal cables				Not Applicable
139	Remove conduit; Assuming 1"				Not Applicable
140	Install conduit in new position				Not Applicable
141	Install replacement cable; assumed single cable #12				Not Applicable
142	Re-commission / testing as required				Not Applicable
143	Engineering / Shop Drawings / Etc.				Not Applicable
144	Premium Time				Not Applicable
145					

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : BAYCHESTER AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)				Not Applicable
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform				Not Applicable
149	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
150	Platform End Gates (PEGs)				Not Applicable
151	Fixed Panels including framing and support; 4'-6" High				Not Applicable
152	Spare Parts - Approx. 10% of Material Cost				Not Applicable
153	Platform Edge Reconstruction work				Not Applicable
154	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
155	Conduit running under Platform Edge				Not Applicable
156					
157	Allow loss of production to work at night say 50%				Not Applicable
158					
159	**PREMIUM ASSOCIATED WITH PSD's**				$ -

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : MORRIS PARK

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	523	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	523	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,046**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,046	LF	7	7,322
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,230	SF	12	62,760
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	105	CY	2,500	262,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,048	EA	25	26,200
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,048	EA	25	26,200
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,046	LF	95	99,370
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,046	LF	15	15,690
26	Remove existing platform tiles	1,046	LF	12	12,552
27	Sawcut existing topping concrete at perimeter of removal area	1,046	LF	5	5,230
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,276	SF	8	50,208
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 13'-9" wide strip	620	SF	8	4,960
30	New Work				
31	New concrete topping to match existing	1,046	SF	15	15,690

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : MORRIS PARK

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	620	SF	15	9,300
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,232	SF	750	1,674,000
61	Spare Parts - Approx. 10% of Material Cost	1	LS	196,500	196,500
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : MORRIS PARK

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,046	LF	60	62,760
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	400	LF	60	24,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	450	LF	60	27,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : MORRIS PARK

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,323,517	3,323,517
112					
113	TOTAL PSD WORK:				$ 14,401,908
115					
116	**ADD ALTERNATIVE**				
117					
118	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
119					
120	**ADD**				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)				Not Applicable
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform				Not Applicable
123	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
124	Platform End Gates (PEGs)				Not Applicable
125	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
126	Spare Parts - Approx. 10% of Material Cost				Not Applicable
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger				Not Applicable
129	L6x6x1/2 continuous angle				Not Applicable
130	Drilling and bolting - 4 bolts at each connection				Not Applicable
131	Platform Edge Repair				
132	Remove concrete platform edge				Not Applicable
133	Platform edge repair				Not Applicable
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Not Applicable
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-5 Line Stations

8-Aug-19

STATION : MORRIS PARK

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)				Not Applicable
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform				Not Applicable
148	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
149	Platform End Gates (PEGs)				Not Applicable
150	Fixed Panels including framing and support; 4'-6" High				Not Applicable
151	Spare Parts - Approx. 10% of Material Cost				Not Applicable
152	Platform Edge Reconstruction work				Not Applicable
153	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
154	Conduit running under Platform Edge				Not Applicable
155					
156	Allow loss of production to work at night say 50%	1	LS	-	-
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				$ -

New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR '6' SERVICE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

FINAL SUBMITTAL DATE: April 12, 2019

STV 100 Years

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Appendices
Appendix A: Tier 2-3 Technology Assessment
Appendix B: Structural Feasibility Report
Appendix C: Emergency Egress Width Analysis
Appendix D: Maintenance Cost Estimate
Appendix E: Rough Order of Magnitude Costs

Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. Our Tier 1 analysis found no instances of door misalignment between car classes for this line. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 38 newly evaluated stations, 33 have been found to be not suitable for the installation of PSDs.

[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to half-height barriers]

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues: the platform edge barriers are 15" wide. Where an existing object (wall, stair, and railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Under the following conditions, PSDs are declared infeasible:
  - Limit the ability of a wheelchair to turn within a 5'-0" circle
  - Limit path of travel to less than a 32" pinch width (defined as an obstruction that measures less than 2'-0" longitudinally, i.e. columns)
  - Limit path of travel to be less than a 36" corridor as defined by the edge of a staircase, railing or room
- Insufficient space for the PSD equipment room: the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow: due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements regarding the placement of these new barriers in an existing station environment.
- Structural considerations: existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.

- Columns at platform edge: at certain stations, the columns are positioned 16" to 24" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space.

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the previously proposed 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the PSD barriers and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is used for refuse removal at all of the 6-line stations. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the (off) loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in damage from these carts along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 13% of the '6' Line Stations. Total implementation cost would be $136.6M for APGs and $172.3M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; that estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of $931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 5 feasible stations, the aggregate annual maintenance cost would be $4.6M.

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Summary Table

(13% Feasible 5/38)

MRN No.	Station Names	Station Type	Platform Type	Feasibility	Issues/Reason for Failure	Cost APGs	Cost PSDs
360	Pelham Bay Pk	ELV	Island	No	Precast Platform	-	-
361	Buhre Avenue	ELV	Side	No	Precast Platform	-	-
362	Middletown Rd	ELV	Side	No	Precast Platform	-	-
363	Westchester Sq.	ELV	Side	No	Precast Platform	-	-
364	Zerega Avenue	ELV	Side	No	Precast Platform	-	-
365	Castle Hill Avenue	ELV	Side	No	Precast Platform	-	-
366	Parkchester	ELV	Island	No	Precast Platform	-	-
367	St. Lawrence Avenue	ELV	Side	No	Precast Platform	-	-
368	Morrison Ave Soundview	ELV	Side	No	Precast Platform	-	-
369	Elder Avenue	ELV	Side	No	Precast Platform	-	-
370	Whitlock Avenue	ELV	Side	No	Precast Platform	-	-
371	Hunts Point Avenue	SUB	Island	No	ADA Clearance	-	-
372	Longwood Avenue	SUB	Side	No	ADA Clearance	-	-
373	East 149th Street	SUB	Side	Yes	-	$27.2M	$34.2
374	East 143rd Street	SUB	Side	No	No PSD Room Location	-	-
375	Cypress Avenue	SUB	Side	No	No PSD Room Location	-	-
376	Brook Avenue	SUB	Side	Yes	-	$27.1M	$34.0M
377	3rd Ave-138th Street	SUB	Island	No	ADA Clearance	-	-
392	125th Street	SUB	Island	No	ADA Clearance	-	-
393	116th Street	SUB	Side	No	No PSD Room Location	-	-
394	110th Street	SUB	Side	No	No PSD Room Location	-	-
395	103rd Street	SUB	Side	Yes	-	$27.6M	$34.5M
396	96th Street	SUB	Side	No	Egress Path	-	-
397	86th Street	SUB	Side	No	ADA Clearance	-	-
398	77th Street	SUB	Side	No	ADA Clearance	-	-
399	68th Street Hunter College	SUB	Side	No	Egress Path	-	-
400	59th Street	-	-	Yes	-	$27.3M	$35.1M
401	51st Street	SUB	Side	Yes	-	$27.3M	$34.4M
402	Grand Central - 42nd St	SUB	Island	No	ADA Clearance	-	-
403	33rd Street	SUB	Side	No	Columns too close to edge	-	-
404	28th Street	SUB	Side	No	Columns too close to edge	-	-
405	23rd Street	SUB	Side	No	Columns too close to edge	-	-
406	14th Street Union Square	SUB	Island	No	Gap fillers	-	-
407	Astor Place 4th Ave	SUB	Side	No	ADA Clearance	-	-
408	Bleeker St. Broadway Lafayette	SUB	Side	No	Columns too close to edge	-	-
409	Spring St.	SUB	Side	No	Columns too close to edge	-	-
410	Canal Street	SUB	Side	No	Columns too close to edge	-	-
411	Brooklyn Bridge City Hall	SUB	Island	No	ADA Clearance	-	-
					TOTAL	$136.6M	$172.3M

1.0 Station Assessments

1.01 – MR 360 | Pelham Bay Park Station

Summary: *Pelham Bay Park Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Pelham Bay Park Station is an elevated station with one island platform. The platform structures is precast concrete. The width of the platforms is approximately 15'-0" throughout. The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Pelham Bay Parkway Station

Figure 2 *– Precast Slab*
Pelham Bay Parkway Station

1.02 – MR 361 | Buhre Avenue Station

Summary: *Buhre Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Buhre Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 12'-0" to 13'-8". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

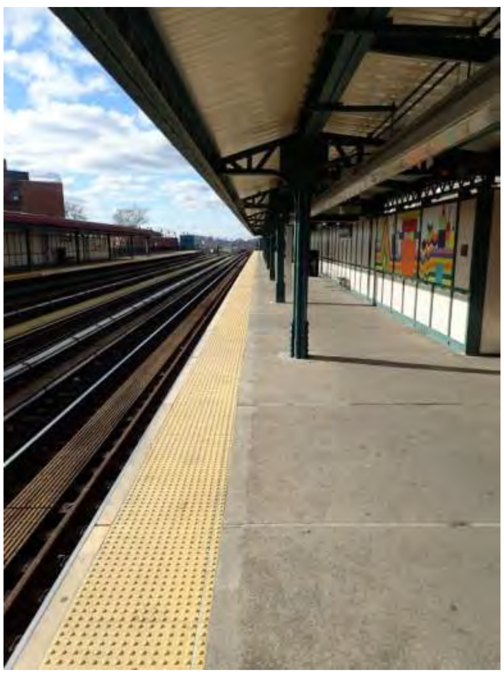

Figure 1 *– General Station Condition*
Buhre Avenue Westchester Avenue Station

Figure 2 *– Precast Slab*
Buhre Avenue Westchester Avenue Station

1.03 – MR 362 | Middletown Road Station

Summary: *Middletown Road Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Middletown Road Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 11-2" to 12'-0". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

***Figure 1** – General Station Condition*
Middletown Road Station

***Figure 2** – Precast Slab*
Middletown Road Station

1.04 – MR 363 | Westchester Square East Tremont Ave Station

Summary: *Westchester Square East Tremont Ave.Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Westchester Square East Tremont Ave. Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 12'-0" to 14'-10". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Westchester Square East Tremont Station

Figure 2 *– Precast Slab*
Westchester Square East Tremont Station

1.05 – MR 364 | Zerega Avenue Station

Summary: *Zerega Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Zerega Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 11'-10" to 11'-2". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Zerega Avenue Station

Figure 2 *– Precast Slab*
Zerega Avenue Station

1.06 – MR 365 | Castle Hill Avenue Station

Summary: *Castle Hill Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Castle Hill Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 11'-10" to 12'-0". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Castle Avenue Station

Figure 2 *– Precast Slab*
Castle Avenue Station

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1.07 – MR 366 | Parkchester Station

Summary: *Parkchester Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Parkchester Station is an elevated station with two center / island platforms. The platform structures are precast concrete. The width of the platforms are approximately 16'-6" throughout. The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Parkchester Station

Figure 2 *– Precast Slab*
Parkchester Station

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1.08 – MR 367 | Saint Lawrence Avenue Station

Summary: *Saint Lawrence Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Saint Lawrence Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 11'-8" to 11'-10". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Saint Lawrence Avenue Station

Figure 2 *– Precast Slab*
Saint Lawrence Avenue Station

1.09 – MR 368 | Morrison Avenue- Soundview Station

Summary: *Morrison Avenue-Soundview Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

The Morrison Avenue - Soundview Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 12'-0" to 14'-6". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Morrison Avenue – Soundview Station

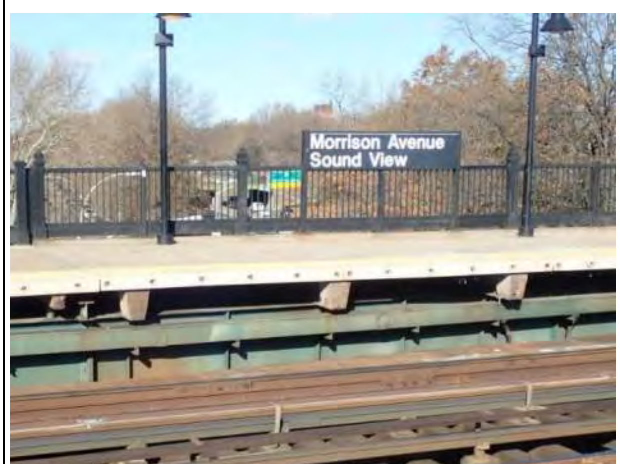

Figure 2 *– Precast Slab*
Morrison Avenue – Soundview Station

1.10 – MR 369 | Elder Avenue Station

Summary: *Elder Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Elder Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 11'-2" to 11'-10". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Elder Avenue Station

Figure 2 *– Precast Slab*
Elder Avenue Station

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1.11 – MR 370 | Whitlock Avenue Station

Summary: *Whitlock Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B).*

Description

The Whitlock Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 11'-10" to 12'-0". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Whitlock Avenue Station

Figure 2 *– Precast Slab*
Whitlock Avenue Station

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1.12 – MR 371 | Hunts Point Avenue Station

Summary: *Hunts Point Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 31" (see figure 1).*

Description

The Hunts Point Avenue Station is a below-grade station with two straight center / island platforms. The platform structures are cast-in-place concrete. The corridor width at the southern end of the southbound platform is 3'-10". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 31" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Area of ADA non-compliance*
Hunts Point Avenue Station

1.13 – MR 372 | Longwood Avenue Station

Summary: *Longwood Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

The Longwood Avenue Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The corridor width at the southern end of the southbound platform is 3'-4". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 25" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Area of ADA non-compliance*
Longwood Avenue Station

1.14 – MR 373 | East 149th Street Station

Summary: *East 149th Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power capacity is adequate.*

Description

East 149th Street Station is a below-grade station with two side platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are located throughout most of the length of the platforms. Column faces measure approximately 4'-2" from the platform edge. The platform widths are approximately 12-0" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located in the northbound control area (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are mildly curved. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the last thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would be required for the installation of an APG system.

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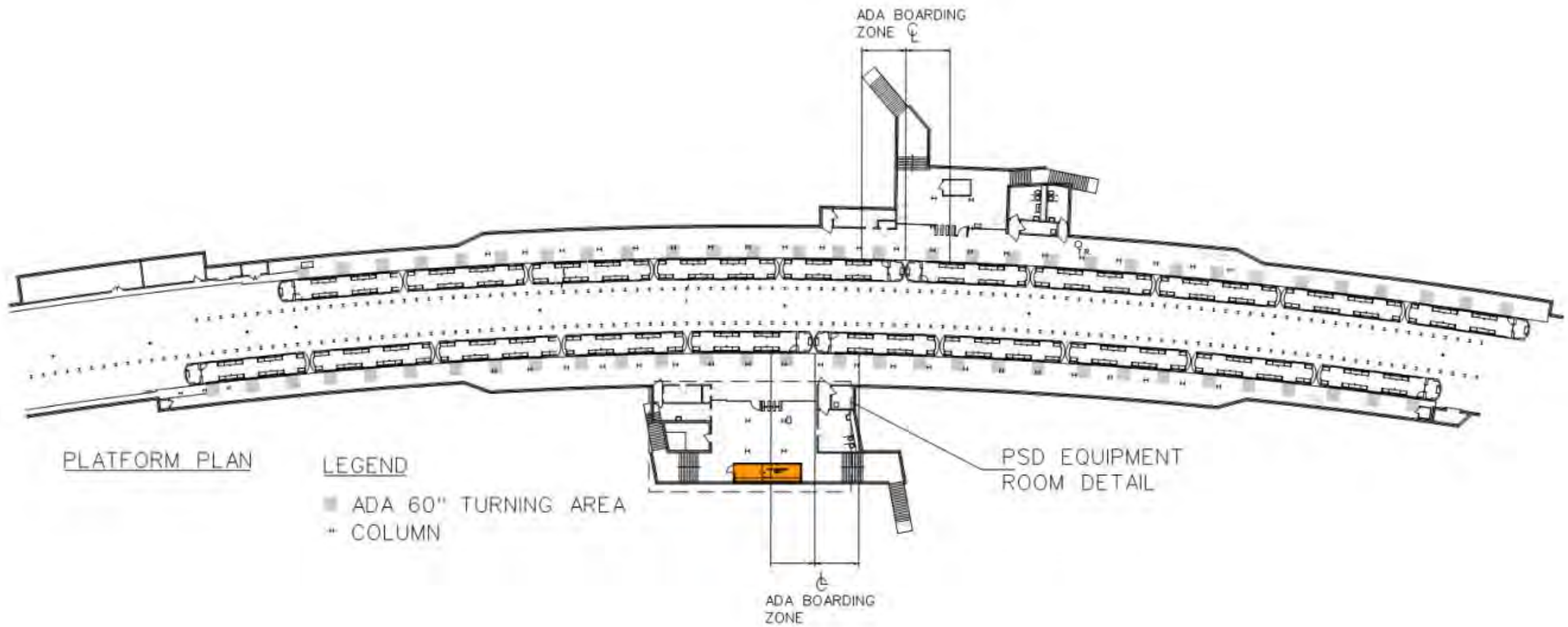

***Figure 1** – Overall Station Plan*
East 149th Street Station

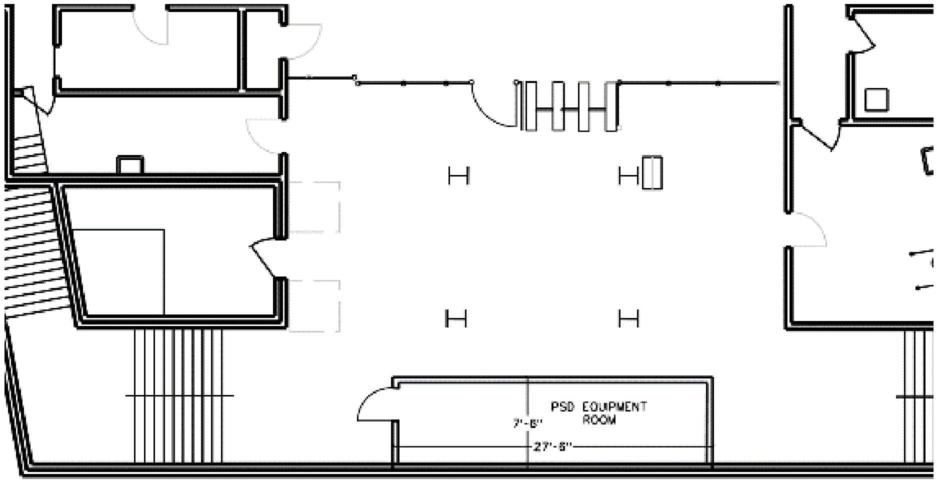

Figure 2 *– PSD Equipment Room 1 Detail*
East 149th Street Station

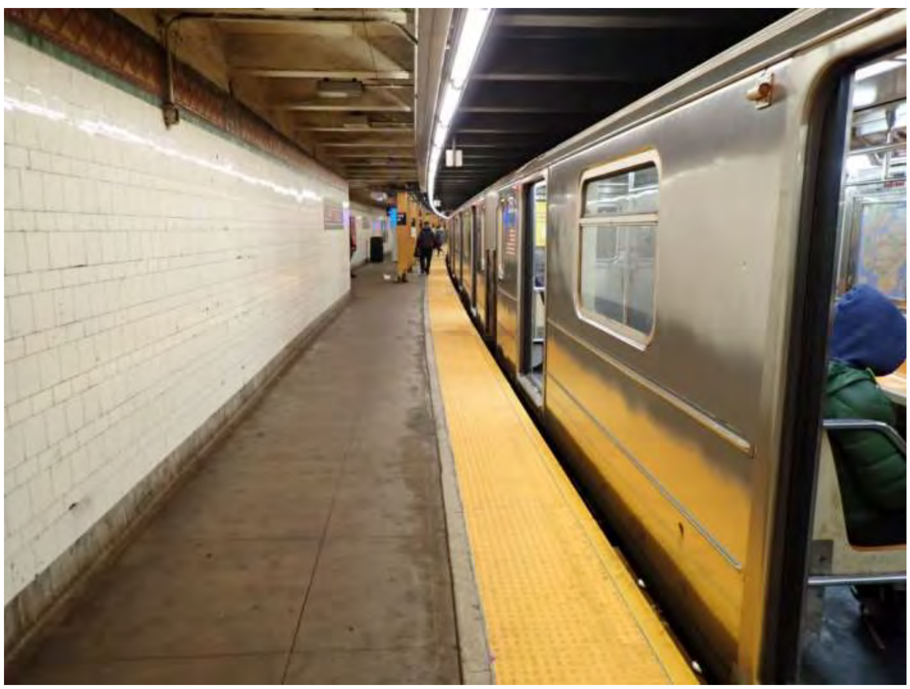

Figure 3 *– Typical platform view*
East 149th Street Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 & 2 see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)	
Station Name	East 149th Street
Peak Demand Load from ConEd Report, (kW)	39.2
Apparent Power (kVA)	49.0
Station Peak Demand Load, Max Current, (A)	136.1
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	294.2
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	506
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey and 1 line diagram, having 800 A Service switch. Station has (2) separate meter readings for each Normal & Reserve service.

Table 1. Normal Service Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)	
Station Name	East 149th Street
Peak Demand Load from ConEd Report, (kW)	13.6
Apparent Power (kVA)	17.0
Station Peak Demand Load, Max Current, (A)	47.2
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	205
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	595
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey and 1 line diagram, having 800 A Service switch. Station has (2) separate meter readings for each Normal & Reserve service.

Table 2. *Reserve Service Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.2M to install APGs and $34.2M to install PSDs (See Appendix E)

1.15 – MR 374 | East 143rd Street – Saint Mary's Station

***Summary:** East 143rd Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

East 143rd Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns on each platform.

Due to the limited width of the existing platforms, there is no available space for the equipment room. Figure 2 below shows the minimum width required (12'-11") for construction of a PSD equipment room on a station platform. Figure 1, below, demonstrates the lack of available space within the control area.

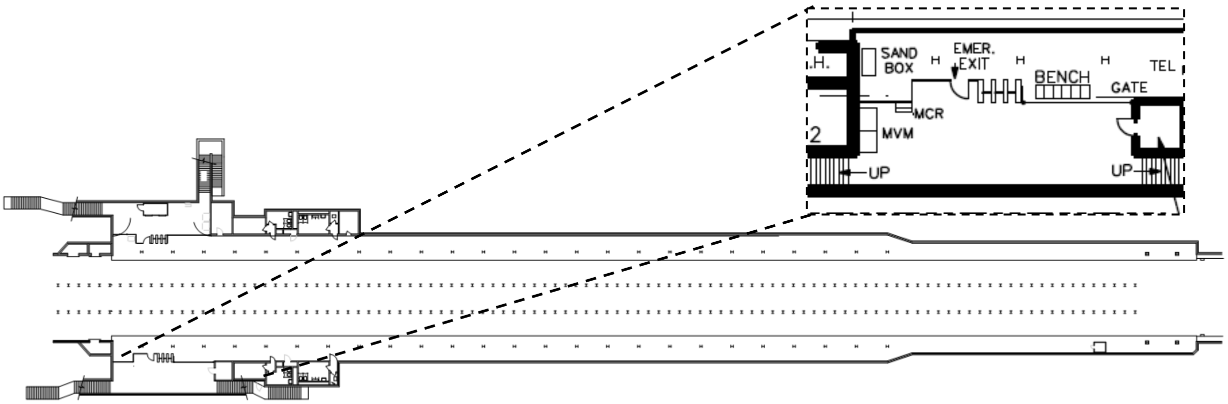

***Figure 1** – Congested/Narrow Station Plan*
East 143rd Street Station

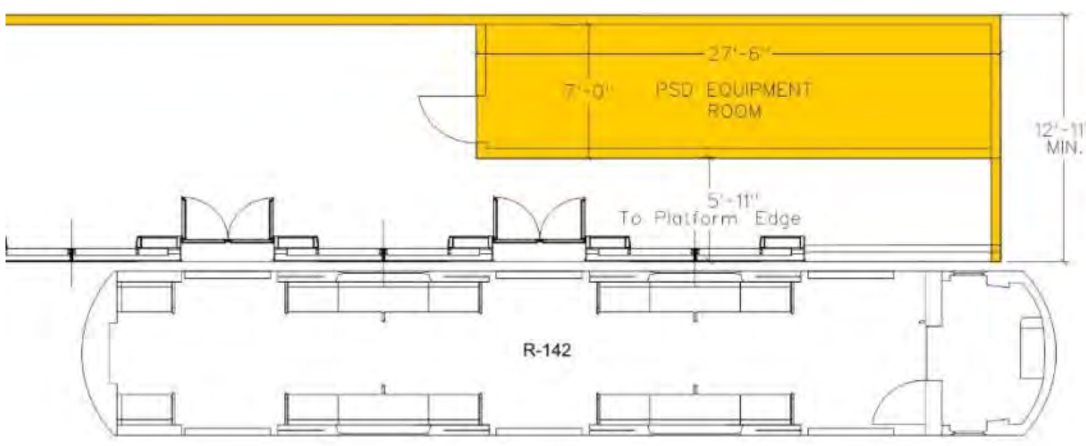

***Figure 2 –** Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimension

1.16 – MR 375 | Cypress Avenue Station

Summary: *Cypress Avenue Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

Cypress Avenue Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns on each platform.

Due to the limited width of the existing platforms, there is no available space for the equipment room. Figure 2 below shows the minimum width required (12'-11") for construction of a PSD equipment room on a station platform. Figure 1, below, demonstrates the lack of available space within the main control area.

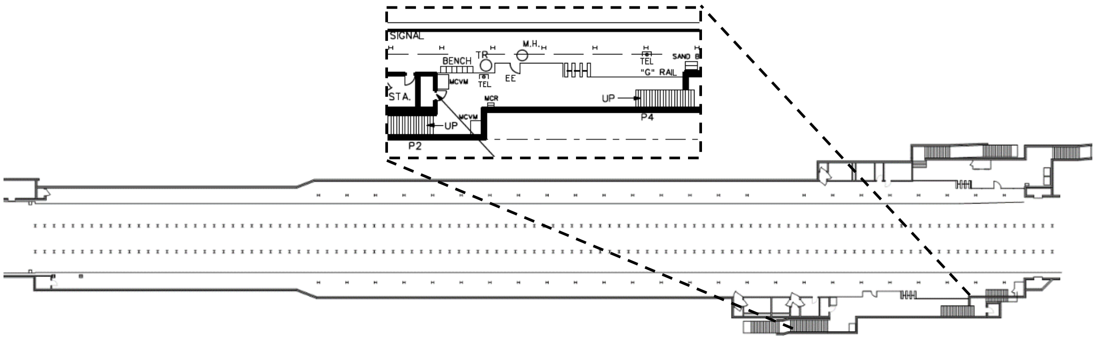

***Figure 1** – Congested/Narrow Station Plan*
Cypress Avenue Station

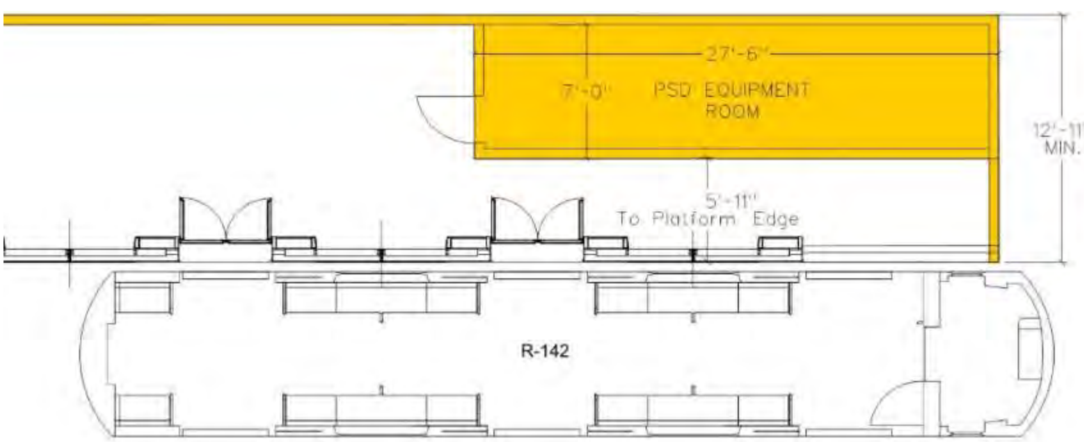

Figure 2 – Diagram demonstrating minimum platform width dimensions
(A Division train shown; B Division requires same dimension

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1.17 – MR 376 | Brook Avenue Station

Summary: *Brook Avenue Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power capacity is adequate.*

Description

Brook Avenue Station is a below-grade station with two straight side platforms (**see Figure 1**). The platform structures are cast-in-place concrete. Columns are located through the central third of the platforms along the platform edge. The platform widths vary from approximately 7'-10" to 11-10". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located in the northbound control area (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges appear to be original to the station construction. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would be required for the installation of both an APG and PSD system.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for '6' Line Stations
(Brook Avenue Station)

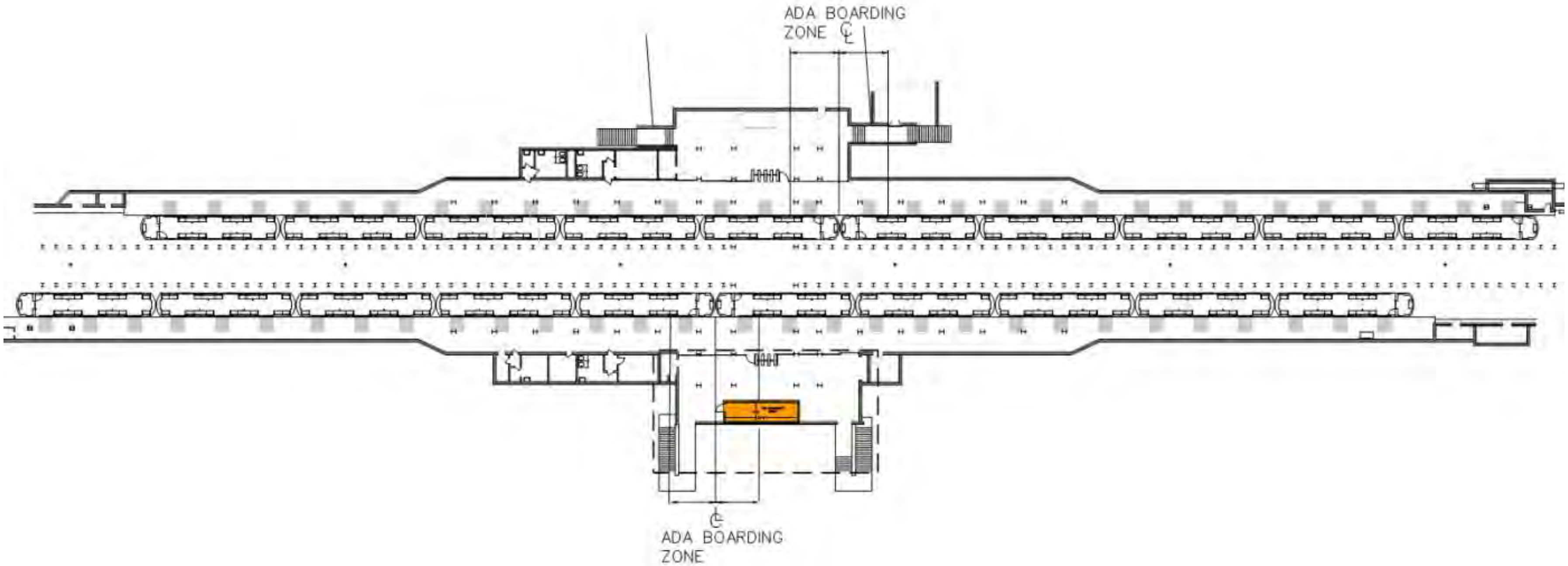

***Figure 1** – Overall Station Plan*
Brook Avenue Station

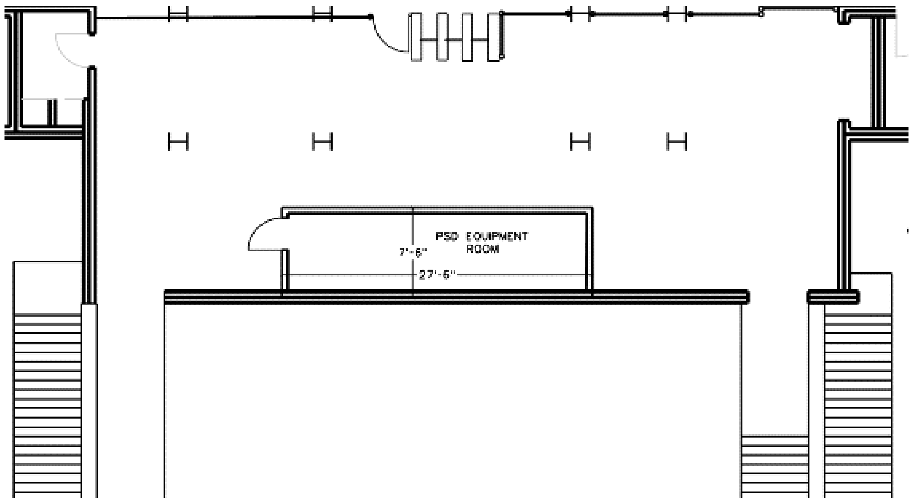

***Figure 2** – PSD Equipment Room Detail*
Brook Avenue Station

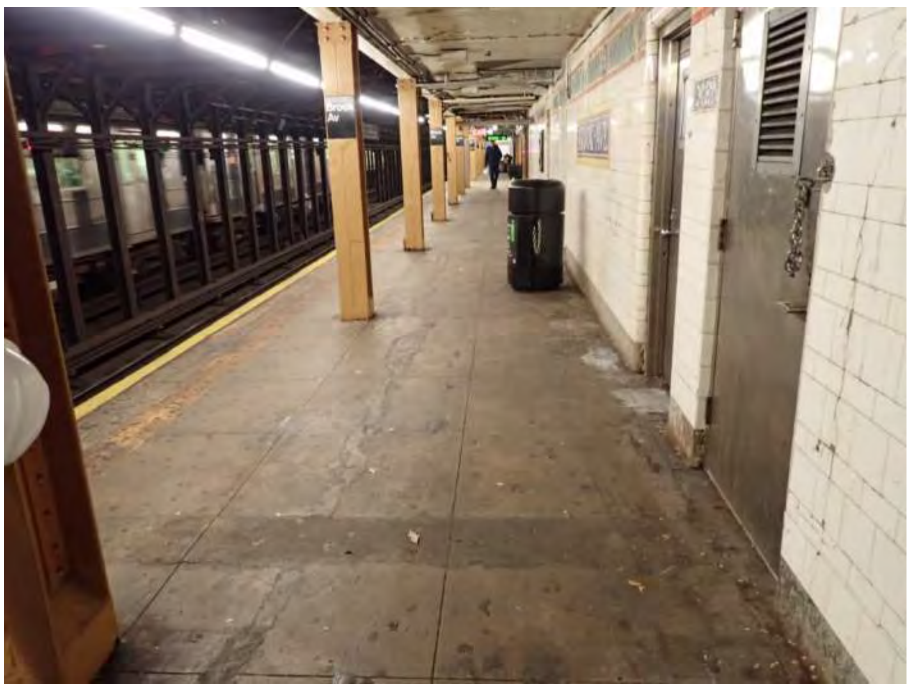

***Figure 3** – Typical platform view*
Brook Avenue Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. An analysis of electrical reserve service could not be performed due to inaccessibility during survey. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)	
Station Name	Brook Avenue
Peak Demand Load from ConEd Report, (kW)	55.2
Apparent Power (kVA)	69.0
Station Peak Demand Load, Max Current, (A)	191.7
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	349.8
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	450
Is Electrical Service Adequate?	Peak Demand Load from ConEd Report, (kW)
Notes	Service rating is based on field survey and 1 line diagram, having 800 A Service switch. Station has (2) separate meter readings for each Normal & Reserve service.

***Table 1**. Normal Service Power Capacity Analysis*.

Station Power Capacity Analysis (Reserve Service)	
Station Name	Brook Avenue
Peak Demand Load from ConEd Report, (kW)	1.6
Apparent Power (kVA)	2.0
Station Peak Demand Load, Max Current, (A)	5.5
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	164
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	636
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey and 1 line diagram, having 800 A Service switch. Station has (2) separate meter readings for each Normal & Reserve service.

***Table 2**. Reserve Service Power Capacity Analysis*.

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.1M to install APGs and $34.0M to install PSDs (See Appendix E)

1.18 – MR 377 | 3rd Avenue- 138th Street Station

Summary: *3rd Avenue -138th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 27" (see figure 1).*

Description

The 3rd Avenue -138th Street Station is a below-grade station with two straight center / island platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 4'-0' to 17'-10". At the south end of the northbound platform, the width is 4'-0". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 27" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
3rd Avenue -138th Street Station

1.19 – MR 392 | 125th Street

Summary: *125th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1). In addition, the station is infeasible due to the presence of columns near the platform edge (see figure 2).*

Description

125th Street Station is a below-grade station with two levels of straight center / island platforms. The no. 6 train utilizes both the upper and lower level. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-4' to 29'-8". At the lower platform, the implementation of a platform edge barrier would reduce the lesser width below the required minimum of 36". The remaining 25" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

The upper platform is infeasible for both APGs and PSDs due to the presence of structural columns on the platform which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 2 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA clearance North end of lower platform; 125th Street Station*

Figure 2 *– Columns at 16" from platform edge South end of upper platform*

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1.20 – MR 393 | 116th Street

Summary: *116th Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

116th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. Platform widths vary from 7'-8" to 11'-10". There is a single row of columns on each platform.

Due to the limited width of the existing platforms, there is no available space for the equipment room. Figure 2 below shows the minimum width required (12'-11") for construction of a PSD equipment room on a station platform. Figure 1, below, demonstrates the lack of available space within the main control area.

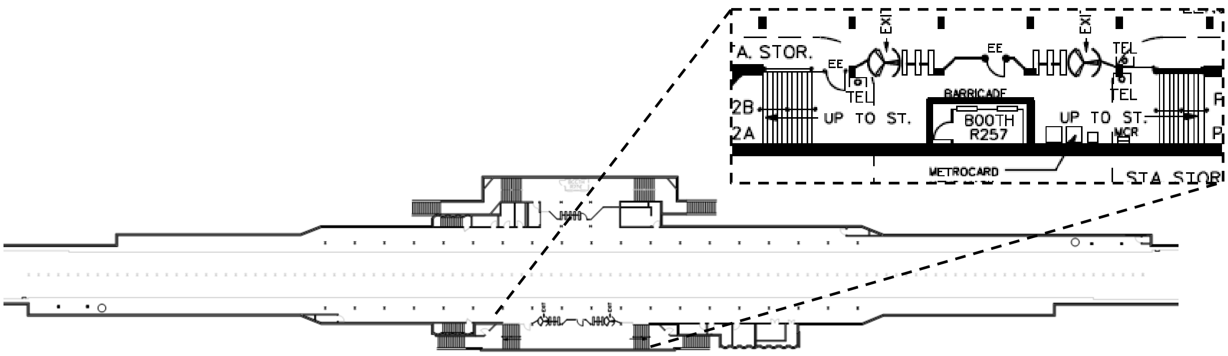

***Figure 1** – Congested/Narrow Station Plan*
116th Street Station

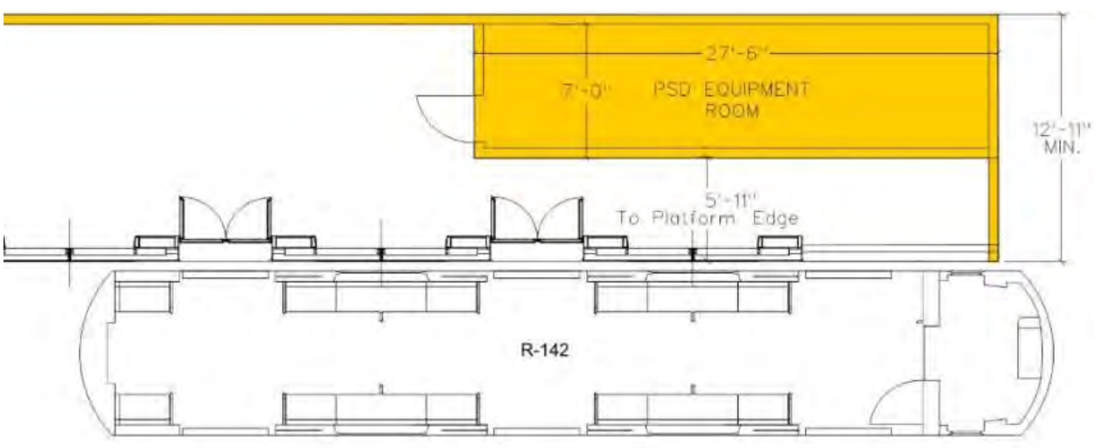

***Figure 2 –** Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimension

1.21 – MR 394 | 110th Street

***Summary:** 110th Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

110th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. Platform widths vary from 7'-8" to 8'-0". There is a single row of columns on each platform.

Due to the limited width of the existing platforms, there is no available space for the equipment room. Figure 2 below shows the minimum width required (12'-11") for construction of a PSD equipment room on a station platform. Figure 1, below, demonstrates the lack of available space within the main control area.

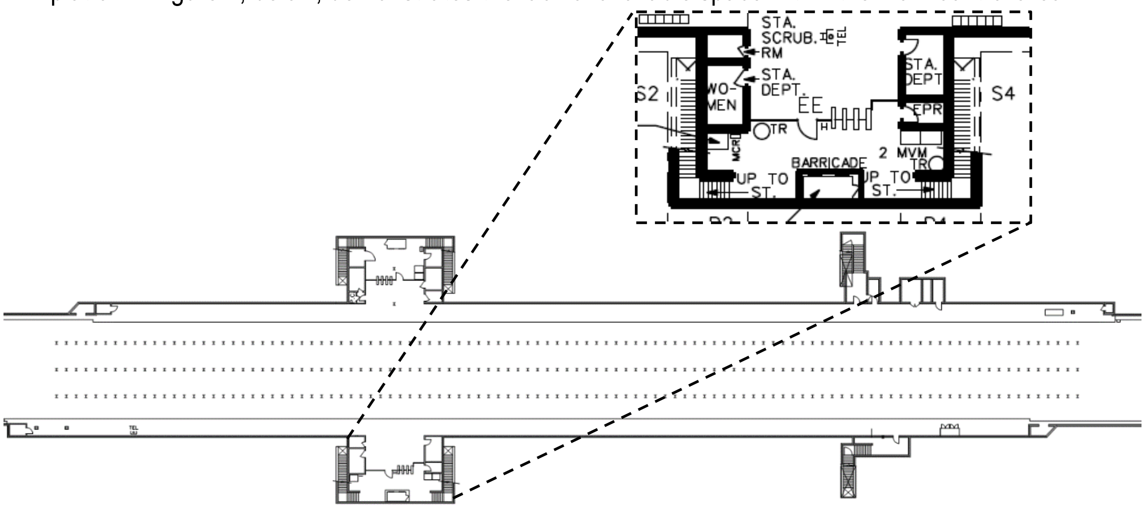

***Figure 1** – Congested/Narrow Station Plan*
110th Street Station

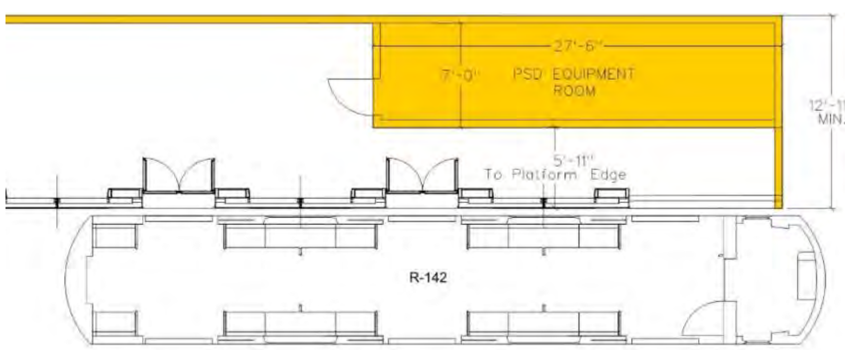

***Figure 2** – Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimension

1.22 – MR 395 | 103rd Street

Summary: *103rd Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

103rd Street Station is a below-grade station with two side platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platforms. The platform widths are approximately 7-4" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the mezzanine control area of the station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

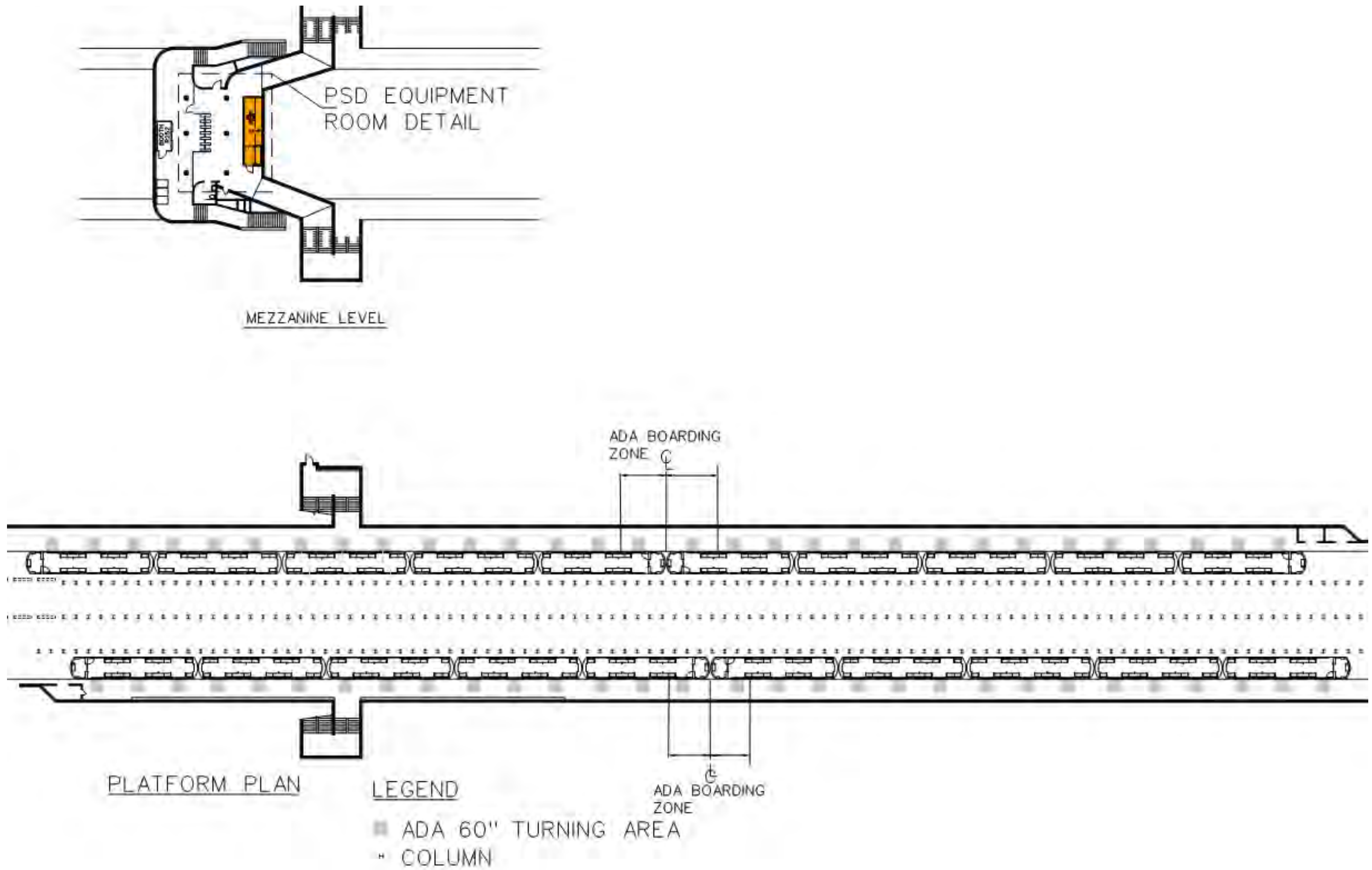

Figure 1 – *Overall Station Plan*
103rd Street Station

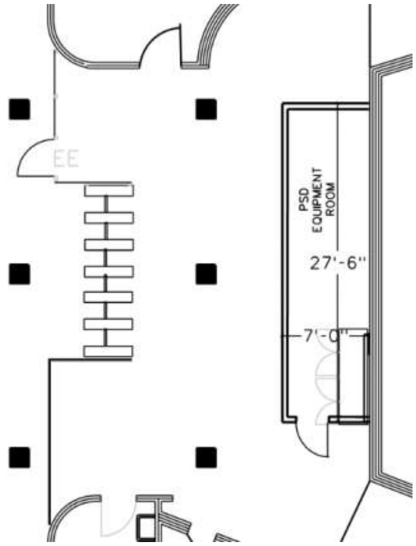

Figure 2 *– PSD Equipment Room Detail*
103rd Street Station

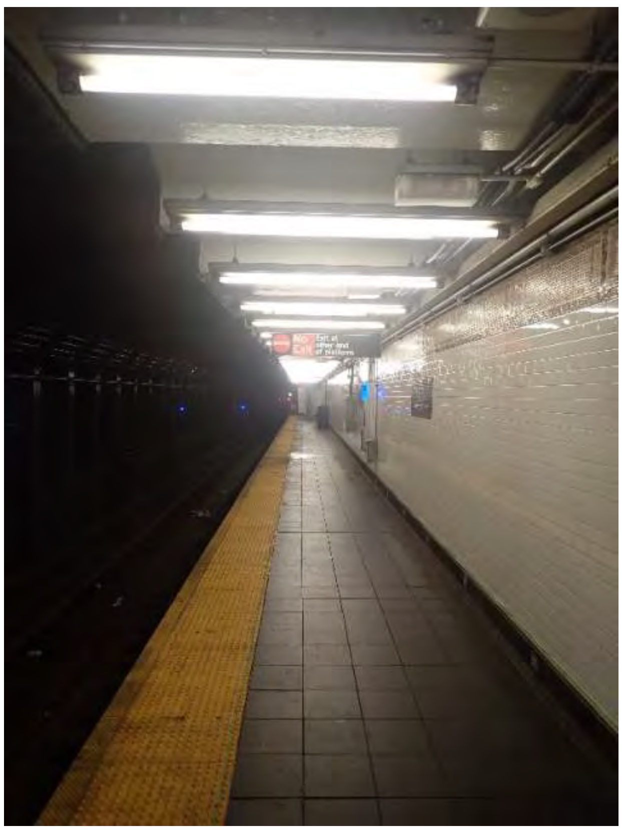

Figure 3 *– Typical platform view*
103rd Street Station

Platform obstructions within 5' of edge:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted perpendicular to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. An analysis of electrical reserve service could not be performed due to inaccessibility during survey. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal service)

Station Name	103rd Street
Peak Demand Load from ConEd Report, (kW)	26.8
Apparent Power (kVA)	33.5
Station Peak Demand Load, Max Current, (A)	93.1
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	251.2
Station Service Power Capacity, (Main SB or SG Rating), (A)	400.0
Service Spare Capacity, (A)	148.9
Is Electrical Service Adequate?	**Yes**
Notes	Service rating of 400A is based on field observations. Station has only (1) meter readings for Normal service. The station Reserve meter was NOT accessible during field survey. (No meter in Reserve EDR) 1 Line diagram provided is not current.

Table 1. Normal Service Power Capacity Analysis

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.6M to install APGs and $34.5M to install PSDs (See Appendix E)

1.23 – MR 396 | 96th Street

Summary: *96th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the north end of the southbound platform as the existing width is 5'-0" (see figure 1).*

Description

96th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-0' to 12'-10".

The platform width at the end of the southbound platform is 5'-0" or 60". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

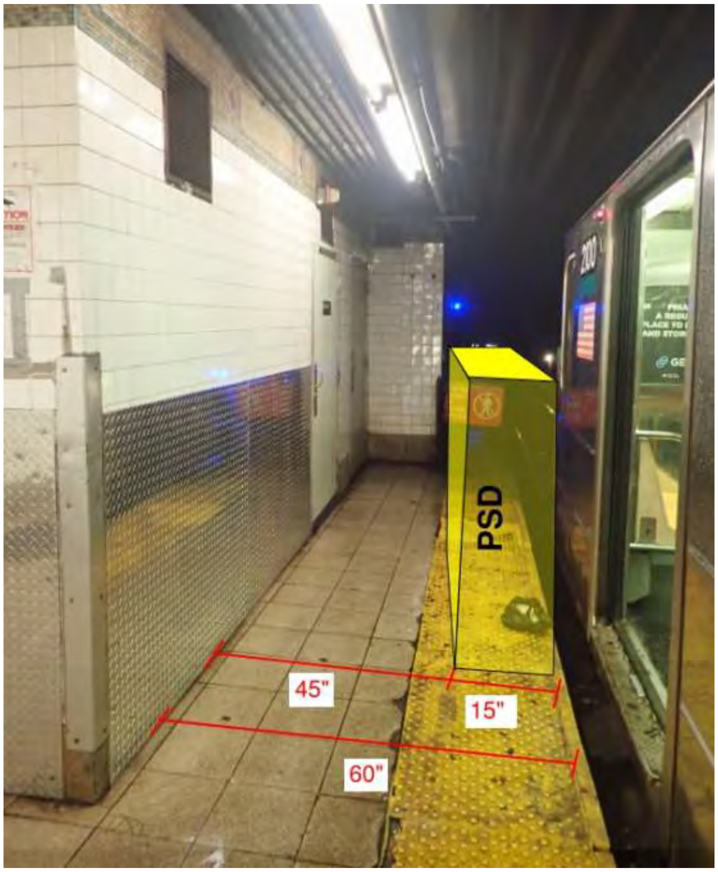

***Figure 1** – Non-Compliant egress condition*
96th Street Station

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1.24 – MR 397 | 86th Street

Summary: *86th Street is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at the center stairs as the remaining width would be 31" (see figure 1).*

Description

The 86th Street Station is a below-grade station consisting of two side platforms on two levels. The No. 6 service normally runs at the upper level. At the upper level, the platforms are approximately 13'-8" wide. The platforms are straight with one row of columns at 46" from the edge of the platform. The implementation of a platform edge barrier would reduce this width at the staircase to 31" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-compliant ADA dimension*
86th Street Station- upper level

1.25 – MR 398 | 77th Street

Summary: *77th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

The 77th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-4' to 11'-8". The implementation of a platform edge barrier would reduce the lesser width below the required minimum of 36". The remaining 25" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-compliant ADA condition*
77th Street Station

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1.26 – MR 399 | 68th Street Hunter College

Summary: *68th Street Hunter College Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of both platforms as the existing width is 4'-2" (see figure 1).*

Description

68th Street Hunter College Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 4'-2' to 11'-10".

Platform width at the southbound end of the northbound & southbound platform is 4'-2" or 50". Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

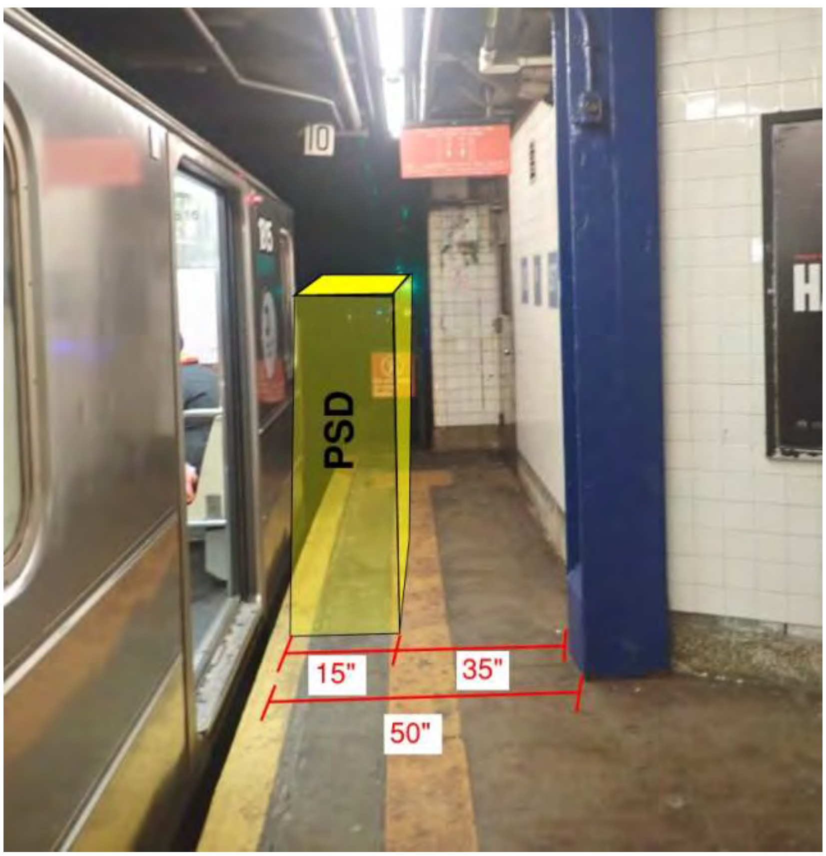

***Figure 1** – Non-Compliant egress condition*
68th Street Hunter College Station

1.27 – MR 400 | 59th Street Station

Summary: *59th Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

59th Street Station is a below ground station with two side platforms on two levels. The No.6 line runs normally on the upper level (**see Figure 1**).. The platform structures are cast-in-place concrete. There is one row of columns located at 3'-10" from the platform edge. The platform widths range from 7-10" to 23'-2". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located on the northbound platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for '6' Line Stations
(59th Street Station)

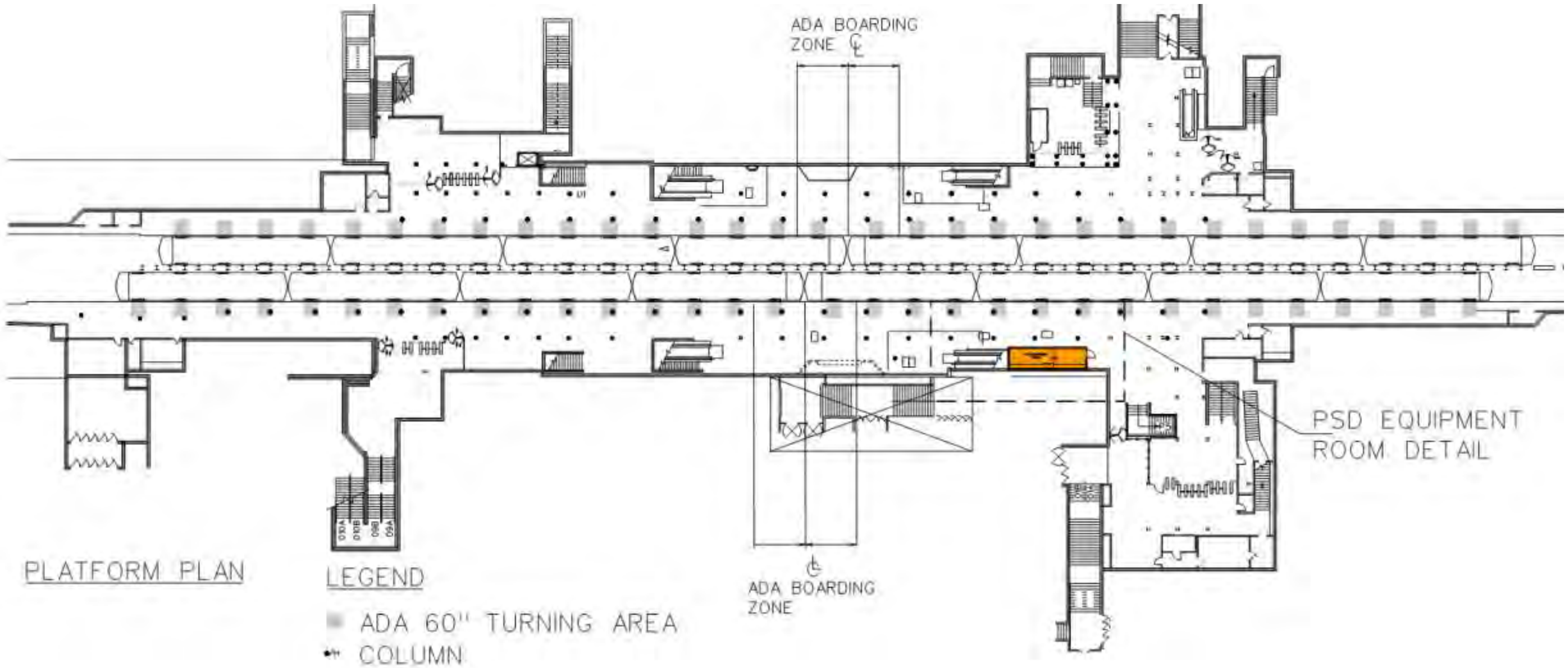

Figure 1 *– Overall Station Plan*
59th Street Station

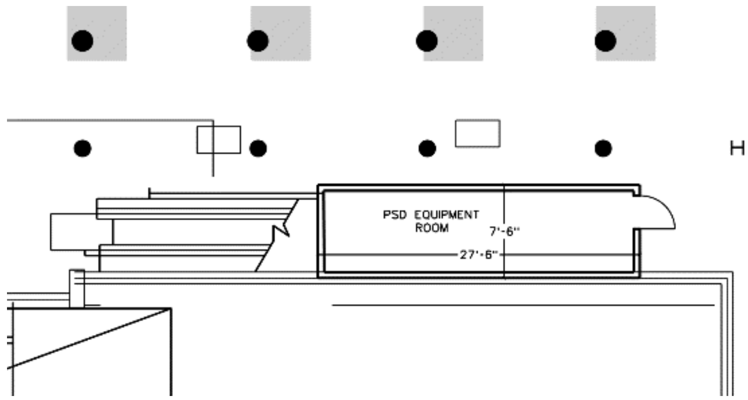

***Figure 2** – PSD Equipment Room Detail*
59th Street Station

***Figure 3** – Typical platform view*
59th Street Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. An analysis of electrical reserve service could not be performed due to inaccessibility during survey. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)	
Station Name	59th Street
Peak Demand Load from ConEd Report, (kW)	65.6
Apparent Power (kVA)	82.0
Station Peak Demand Load, Max Current, (A)	227.8
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	385.9
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	814
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey and 1 line diagram, having 1200 A Service switch. Station has only one meter readings provided for Normal service. No reserve meter reading provided.This analysis is for **Normal service**. No meter in Reserve EDR, but it is in Elevator Machine room and was not accesible during field survey.

Table 1. *Normal Service Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.3M to install APGs and $35.1M to install PSDs (See Appendix E)

1.28 – MR 401 | 51st Street

Summary: *51st Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

51st Street Station is a below-grade station with two side platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are located throughout the platforms along the platform edge. Column faces measure approximately 3'-8" from the platform edge. The platform widths are approximately 11-4" to 20'-0". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the north end of the northbound platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for '6' Line Stations
(51st Street Station)

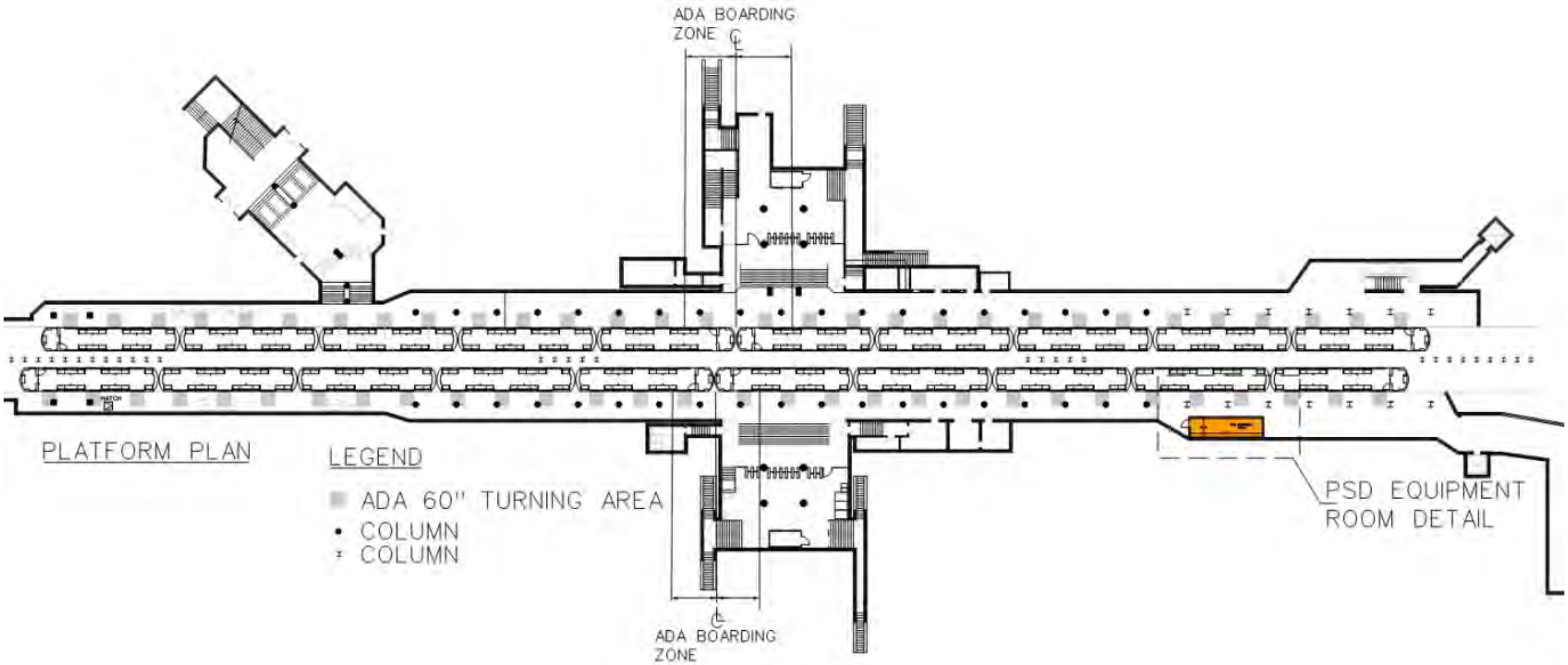

***Figure 1** – Overall Station Plan*
51st Street Station

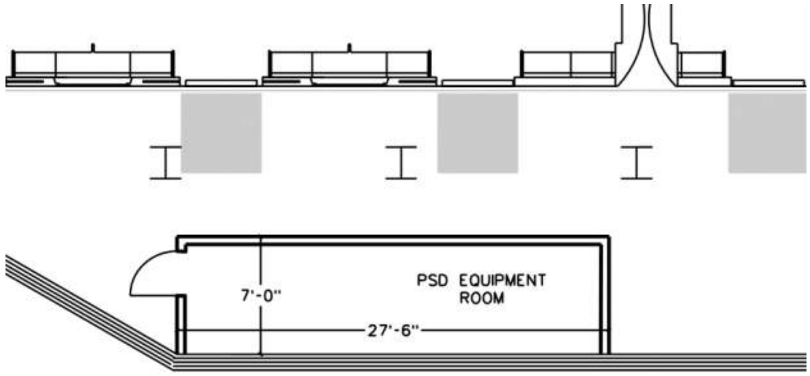

Figure 2 – PSD Equipment Room 1 Detail
51st Street Station

Figure 3 – Typical platform view
51st Street Station

Platform obstructions within 5' of edge:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 & Table 2 see the Power Capacity Analysis for this station.

Station

Power Capacity Analysis (Normal Service)

Station Name	51st Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	28.8
Apparent Power (kVA)	36.0
Station Peak Demand Load, Max Current, (A)	100.0
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	258.1
Station Service Power Capacity, (Main SB or SG Rating), (A)	600
Service Spare Capacity, (A)	342
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey and 1 line diagram, having 600 A Service switch. Station has (2) separate meter readings for each Normal & Reserve service. 1 Line diagram provided is not current.

***Table 1**. Normal Service Power Capacity Analysis*

Station
Power Capacity Analysis (Reserve Service)

Station Name	51st Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	55.0
Apparent Power (kVA)	68.8
Station Peak Demand Load, Max Current, (A)	191.0
Maximum Amount of Doors	60.0
PSD Total Load Including All Miscellaneous Loads, (A)	158.1
Total Load (Station Peak + PSD), (A)	349
Station Service Power Capacity, (Main SB or SG Rating), (A)	700
Service Spare Capacity, (A)	351
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey and 1 line diagram having 700A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service.

Table 2. Reserve Service Power Capacity Analysis

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be \$27.3M to install APGs and \$34.4M to install PSDs (See Appendix E)

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1.29 – MR 402 | 42nd Street Grand Central

Summary: *42nd Street Grand Central Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 31" (see figure 1).*

Description

The 42nd Street Grand Central Station is a below-grade station with two straight center / island platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-10' to 24'-0". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 31" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

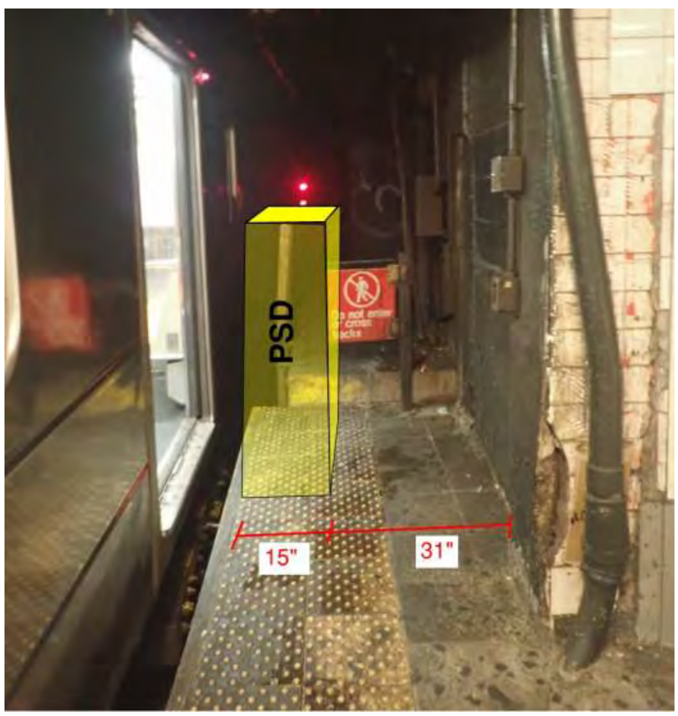

***Figure 1** – Non-compliant ADA condition*
42nd Street Grand Central Station

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1.30 – MR 403 | 33rd Street

Summary: *33rd Street Station is not feasible for both APGs and PSDs as the columns which are located 18" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

33rd Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 18" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 18" from the edge*
33rd Street Station

1.31 – MR 404 | 28th Street

Summary: *28th Street Station is not feasible for both APGs and PSDs as the columns which are located 14" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

28th Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The column pictured in Figure 1 measures approximately 14" from the platform edge. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 14" from the edge*
28th Street Station

1.32 – MR 405 | 23rd Street

Summary: *23rd Street Station is not feasible for both APGs and PSDs as the columns which are located 14" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

23rd Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 14" from the platform edge. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 14" from the edge*
23rd Street Station

1.33 – MR 406 | 14th Street- Union Square

Summary: *14th Union Square Station is not feasible for both APGs and PSDs due to the presence of platform edge gap fillers located at all southbound platform edges. The existing gap fillers are a dynamic assembly that extends the platform edge when a train arrives, and recedes when the train departs. This moving assembly prevents the installation of a static PSD system. Please see figure 1 for reference.*

Description:

Due to the sharp curvature of the platforms at 14th Street Union Square, platform edge gap fillers are necessary to bridge the gap between the train doors and the platform edge.

Figure 1 –*Platform Edge Gap Fillers*
14th Street Union Square Station

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1.34 – MR 407 | Astor Place 4th Avenue

Summary: *Astor Place Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 15" (see figure 1).*

Description

The Astor Place Station is a below-grade station with two curved side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 2'-6' to 10'-8". The implementation of a platform edge barrier would reduce this lesser width below the required minimum of 32". The remaining 15" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
Astor Place Station

1.35 – MR 408 | Bleeker St.-Broadway / Lafayette

Summary: *Bleeker St. Station is not feasible for both APGs and PSDs as the columns which are located 18" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Bleeker Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 18" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 18" from the edge*
Bleeker St. Broadway Lafayette Station

1.36 – MR 409 | Spring St.

Summary: *Spring St. Station is not feasible for both APGs and PSDs as the columns which are located 22" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Spring St. Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 22" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 22" from the edge*
Spring St. Station

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1.37 – MR 410 | Canal Street

Summary: *Canal Street Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Canal Street Station is a below-grade station consisting of two side platforms (this report covers only the Lexington IRT line). It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 16" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 16" from the edge*
Canal Street Station

1.38 – MR 411 | Brooklyn Bridge City Hall

Summary: *Brooklyn Bridge City Hall Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at the center stairs as the remaining width would be 17" (see figure 1).*

Description

The Brooklyn Bridge City Hall Station is a below-grade station consisting of two center / island platforms. The platforms are approximately 15'-6" to 21'-2" wide. The platforms are mildly curved with two rows of columns at 32" from the edge of the platform. The implementation of a platform edge barrier would reduce this width to 17" or less* which would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA condition*
Brooklyn Bridge City Hall Station

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*
>
> - *a. Column location in relation to the platform edge*
> - *b. Platform edge clearance adjacent to stairs and other impediments*
> - *c. Impacts to ADA path of travel and boarding areas*
> - *d. Conflicts of PSD/APG/RPSDs with Signals cables*
> - *e. Sufficient platform width*
> - *f. Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*
>
> - *a. Structural capacity of platforms to accept PSD/APG/RPSDs*
> - *b. Feasibility & location for PSD/APG/RPSDs equipment room*
> - *c. Confirmation of adequate power for PSD/APG/RPSDs*
> - *d. Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> - *e. Determination of communications requirements, availability and cost*
> - *f. Determination of gap detection and entrapment avoidance technology requirements*
> - *g. Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.

k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.

l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
    - Double the amount of motors as PSDs (each motor operating a single leaf).
    - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
    - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
    - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY. Status of doors will be provided to crew via indicator lights, with no automated propulsion cutout.

If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	**Dedicated Loop**	**Wayside Only**
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

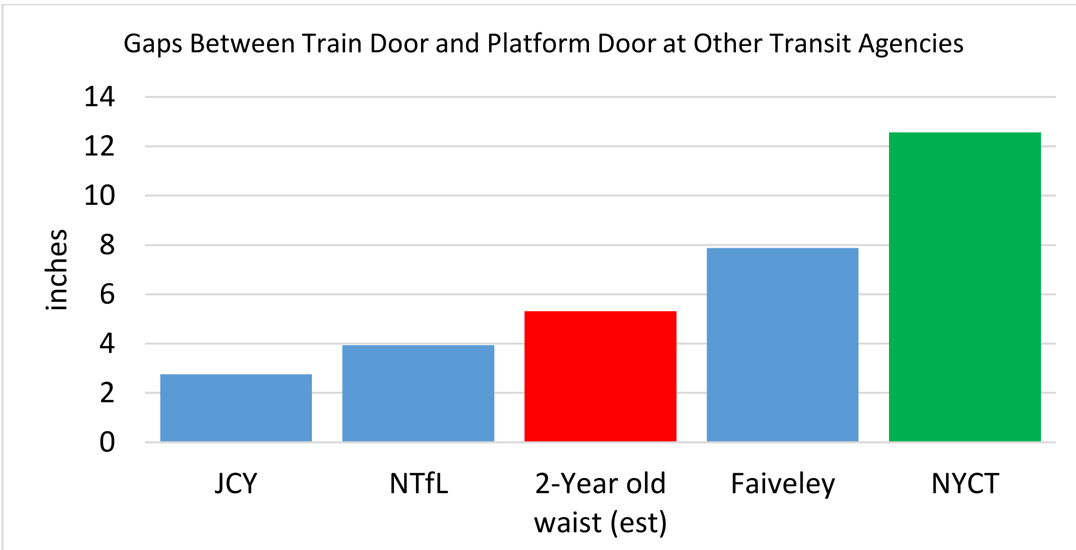


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

 *Figure 3 - Paris: no entrapment detection*	 *Figure 4 - Paris: no entrapment detection*	 *Figure 5 - France ATO: no entrapment detection*
 *Figure 6 - Paris, on curve: used 3 2D scanning lasers per door*	 *Figure 7 - Shanghai: End of platform light detection*	 *Figure 8 - Seoul: Platform observers*

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

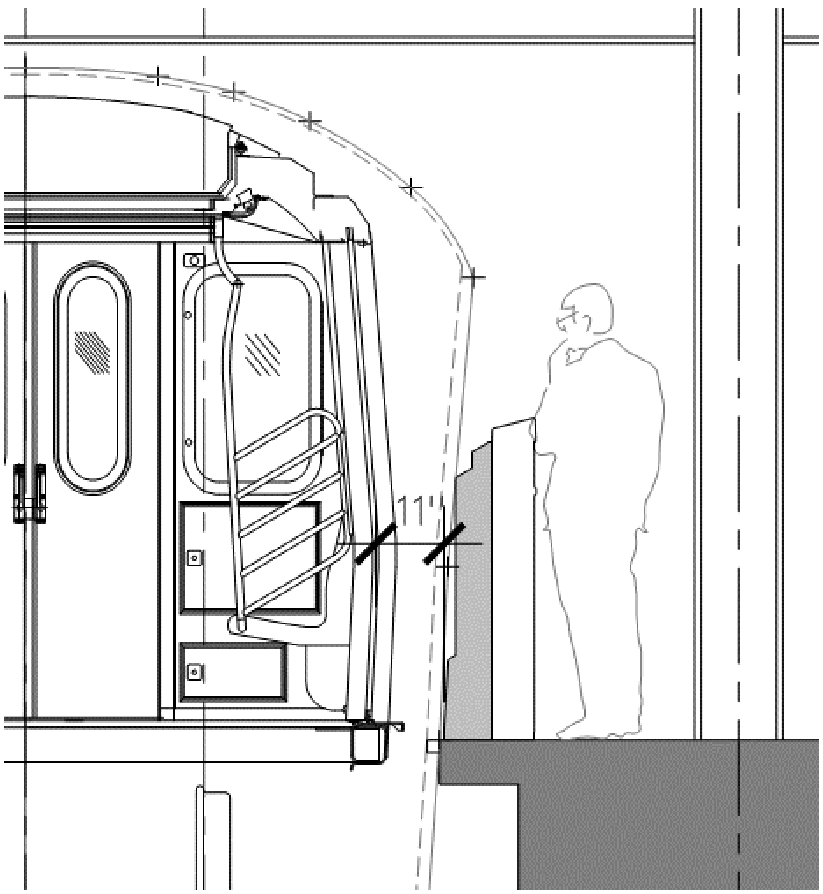


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber “bumpers” on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6” into the line equipment envelope. This would leave a 5” gap between the platform and car doors allowing approximately 2” of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5” by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor’s window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor’s window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **bold/underline**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **<u>In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.</u>**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **<u>When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.</u>**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **<u>When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.</u>**
- **<u>When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.</u>**
- **<u>C/R verifies that 'PSD Closed and Locked' indication is present.</u>**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **<u>Train Operator verifies that 'PSD Closed and Locked' indication is present.</u>**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **<u>and PSD/APG doors</u>** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **<u>and PSD/APG doors</u>** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **<u>of both car side doors and PSD/APG doors</u>** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	PSD System 1	PSD System 2	PSD System 3
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Station Capacity Analysis	**3rd Ave.**	**6th Ave.**	**14 St / Union Square**	**1st Ave.**
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are “existing” as defined by code. All the rolling stock is also to be considered “existing” under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60” radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36” of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

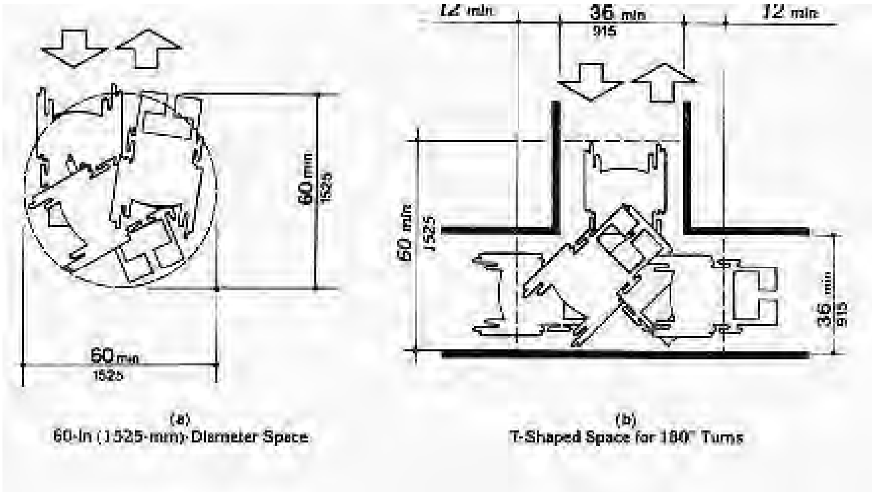
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

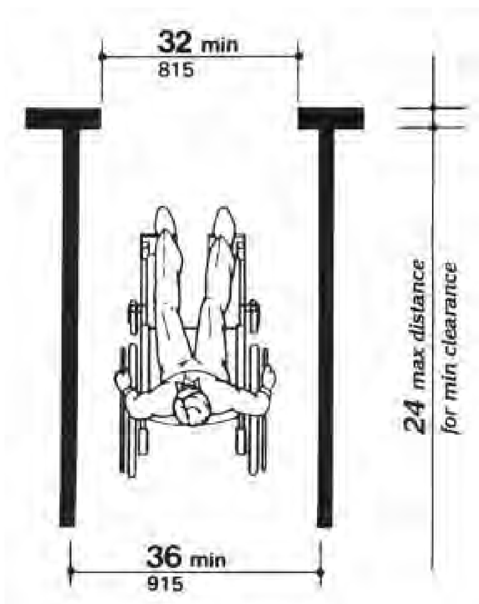


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

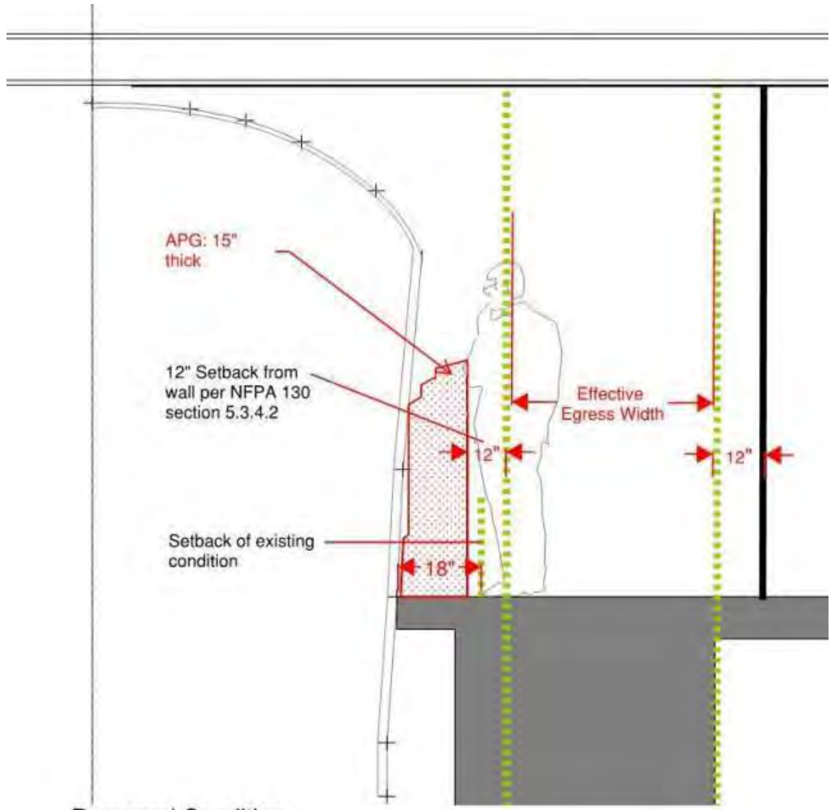
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15" of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

Table of Contents

Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	**Dedicated Loop**	**Wayside Only**
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	**CBTC**		**Dedicated loop**		**Wayside only**	
		Qty.	**subtotal**	**Qty.**	**subtotal**	**Qty.**	**subtotal**
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

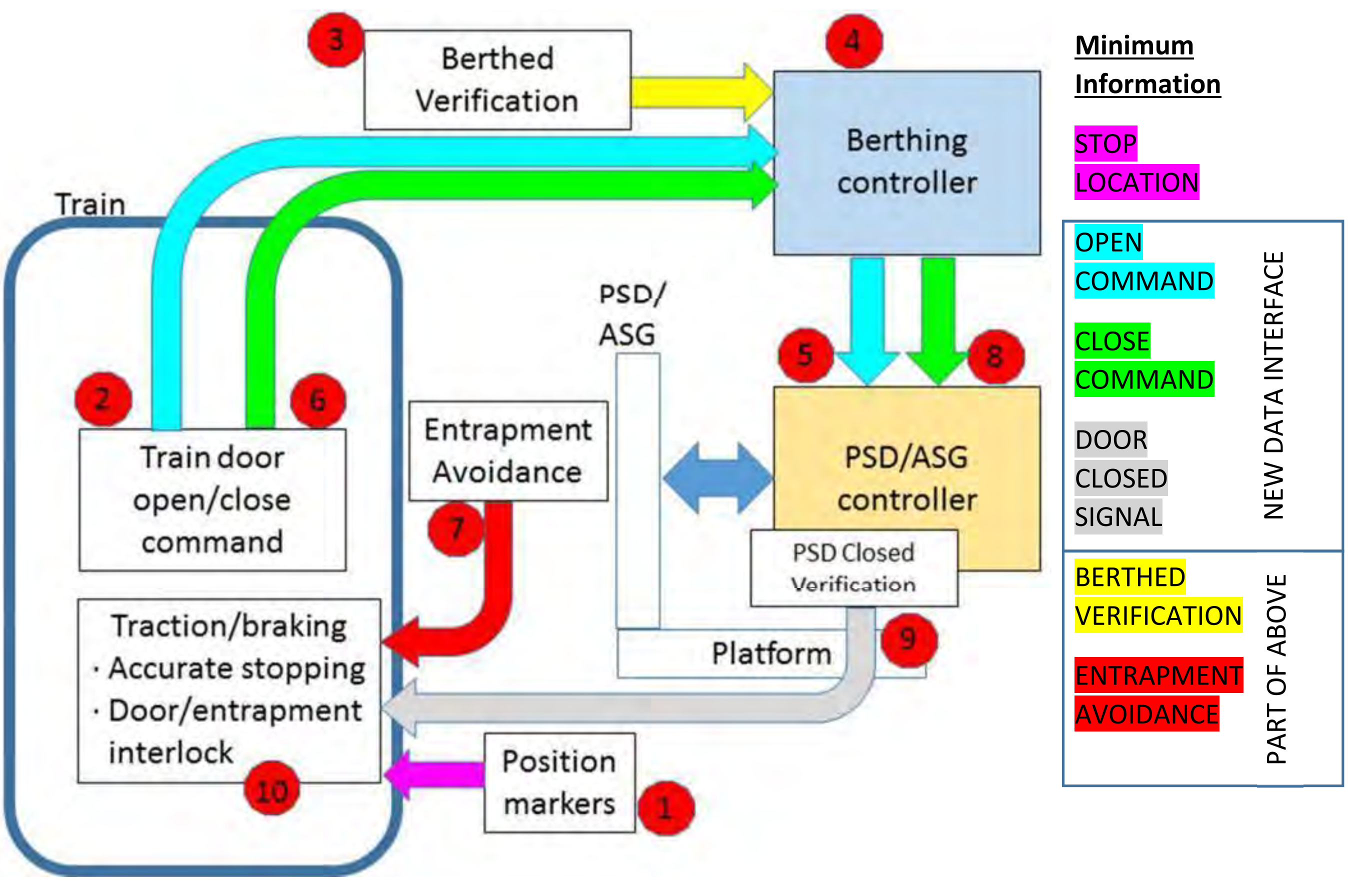
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

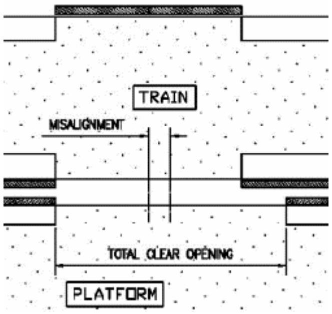
C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5" clear opening, a design for NY should meet the ADA Accessibility Guideline of 36".

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a 'distance totem' which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy's COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

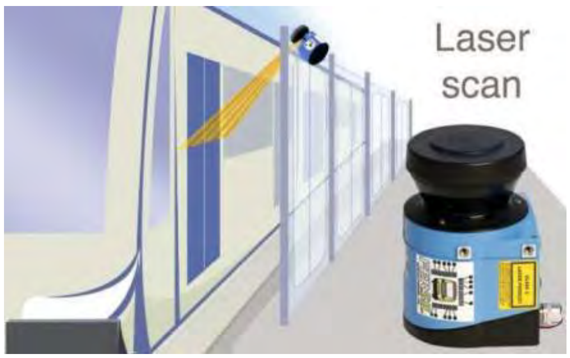
Dedicated Loop

The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically



If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.

For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4'-0"). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

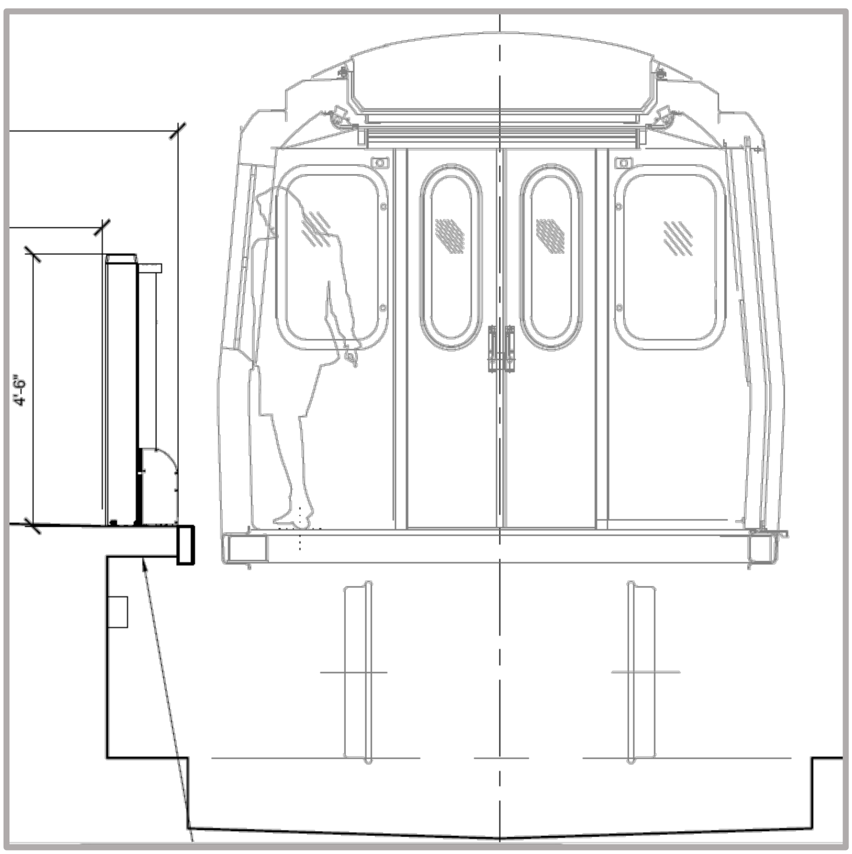


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

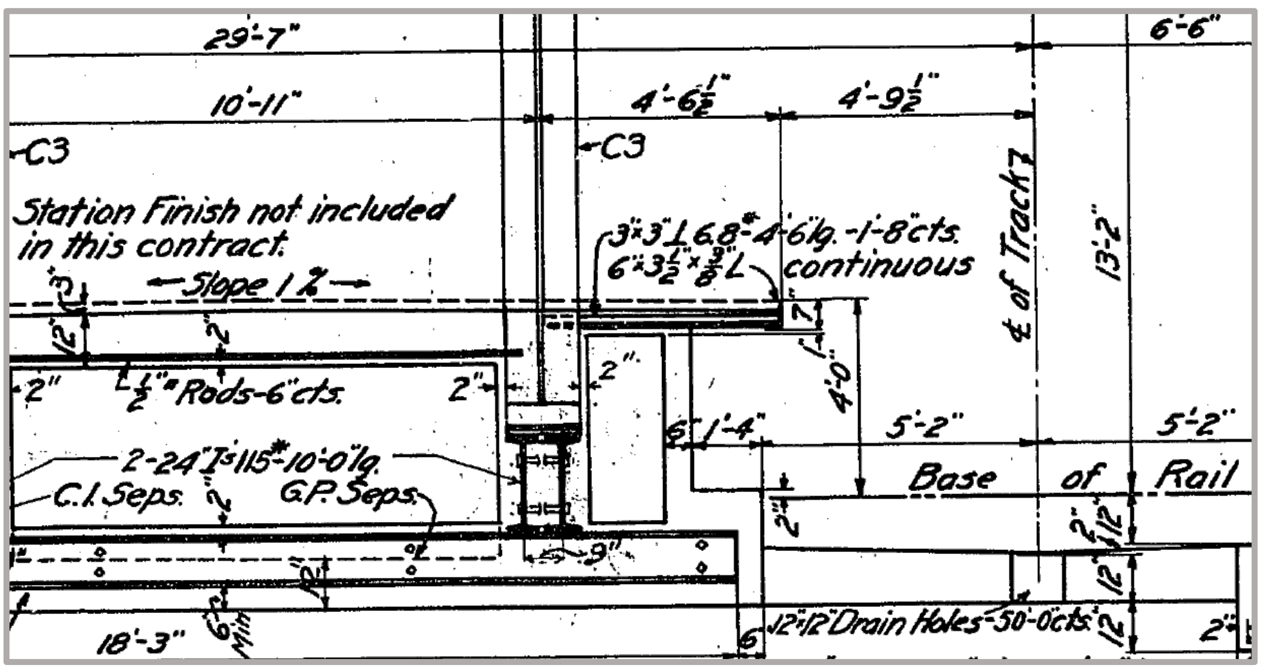


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

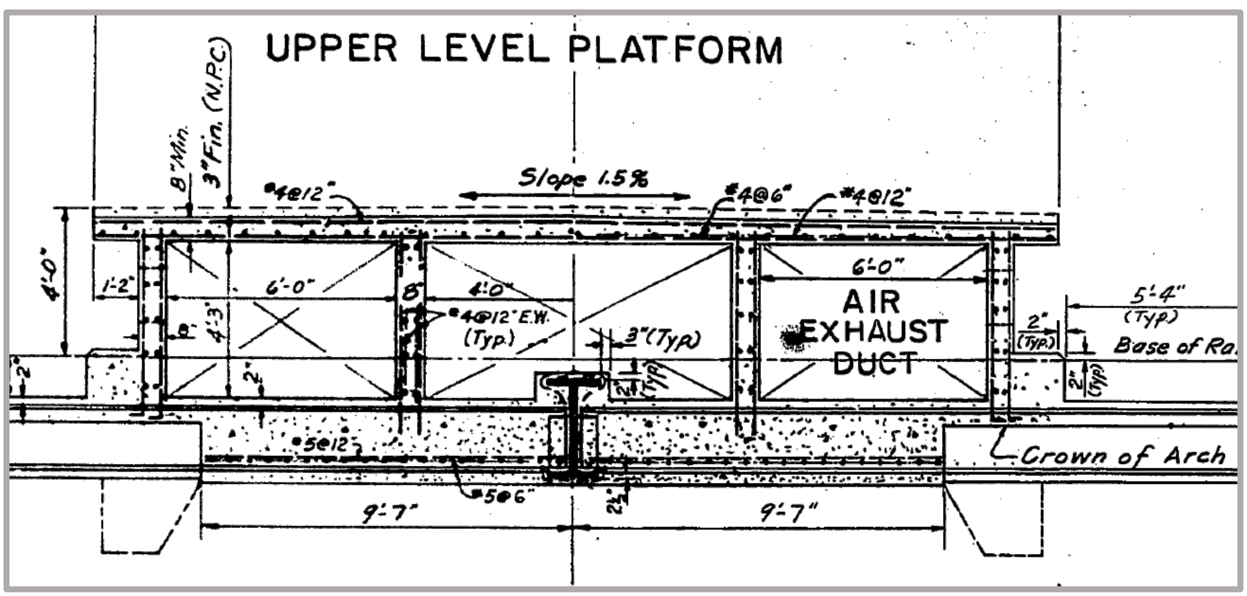


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

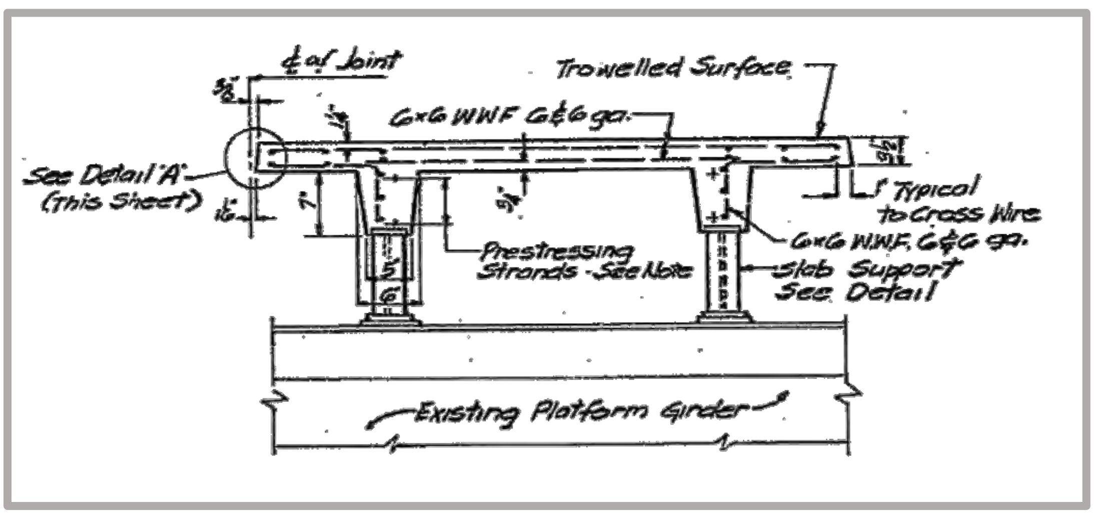


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

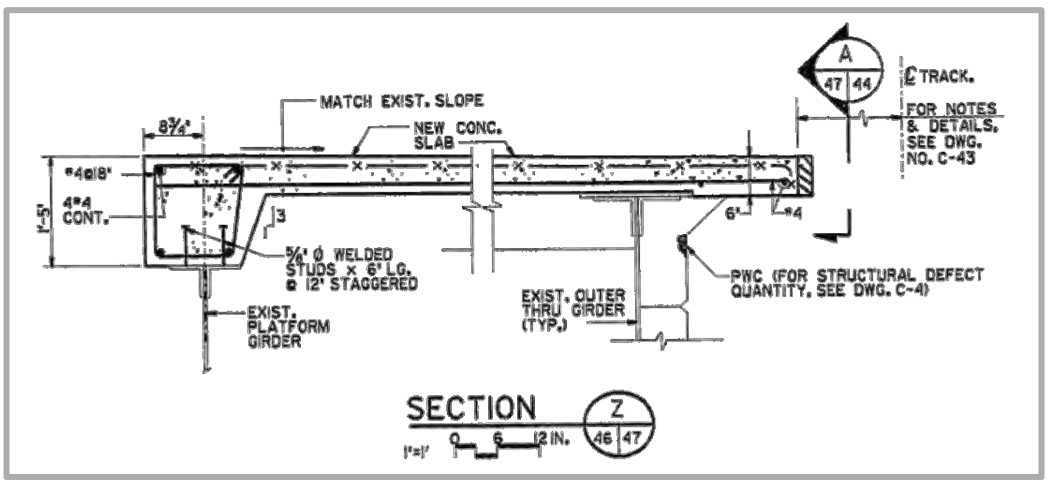


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2'-9"), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

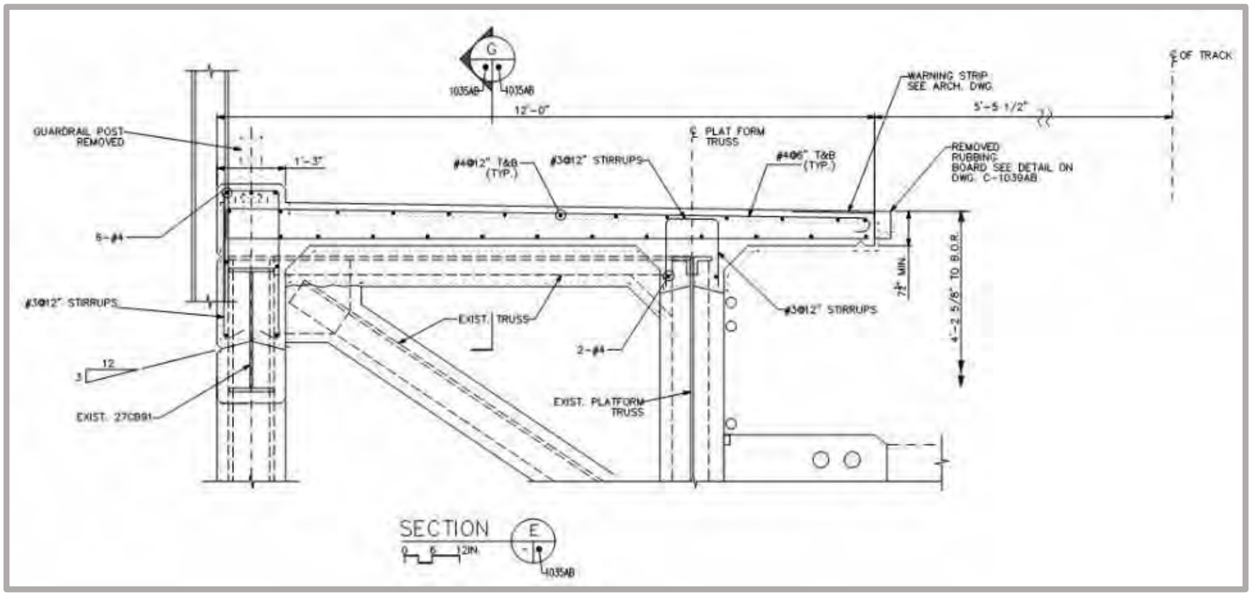


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3” thick structural slab with an approximately 3” thick topping slab. If the topping slab is fully removed, a 6” thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6” thick slab will be sufficient for a cantilever length of up to approximately 3’-0”, greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6” structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6” minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

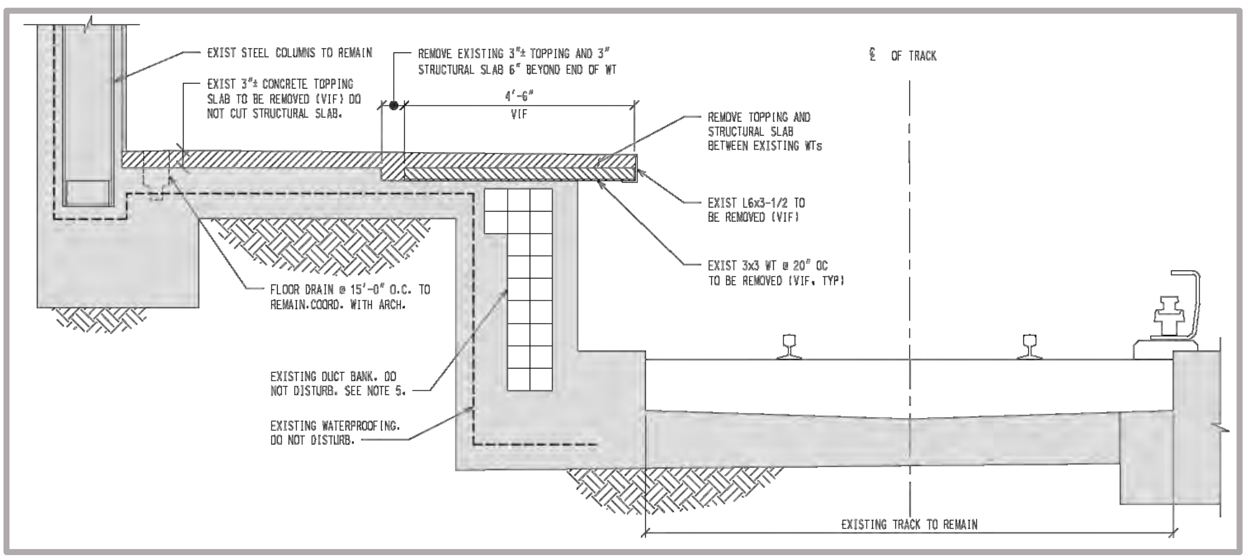


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

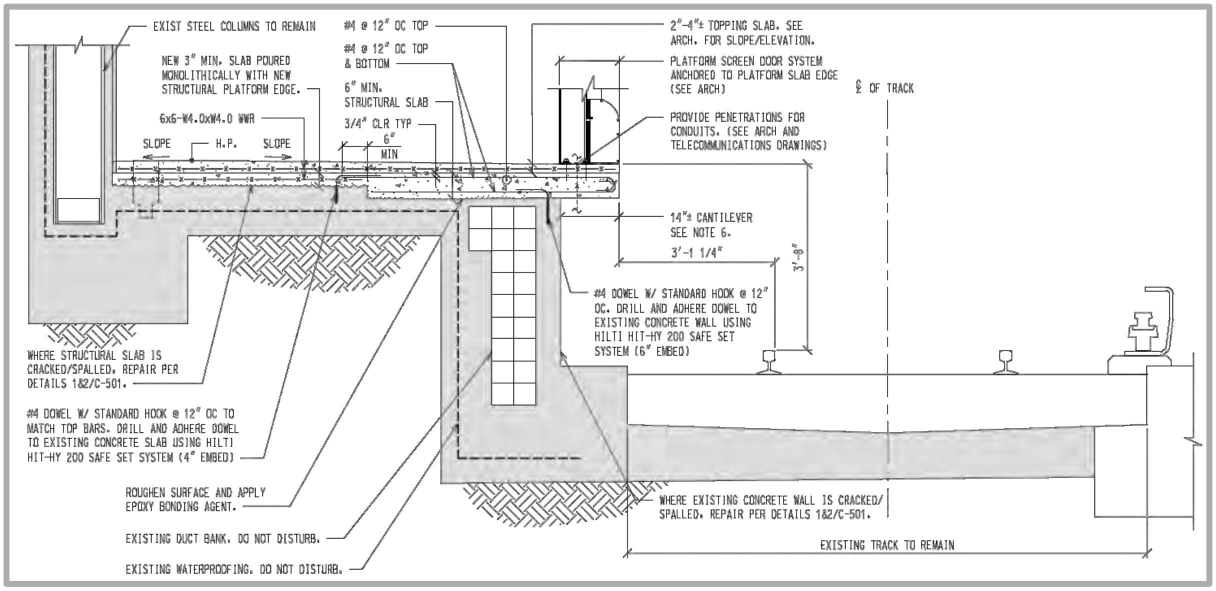


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

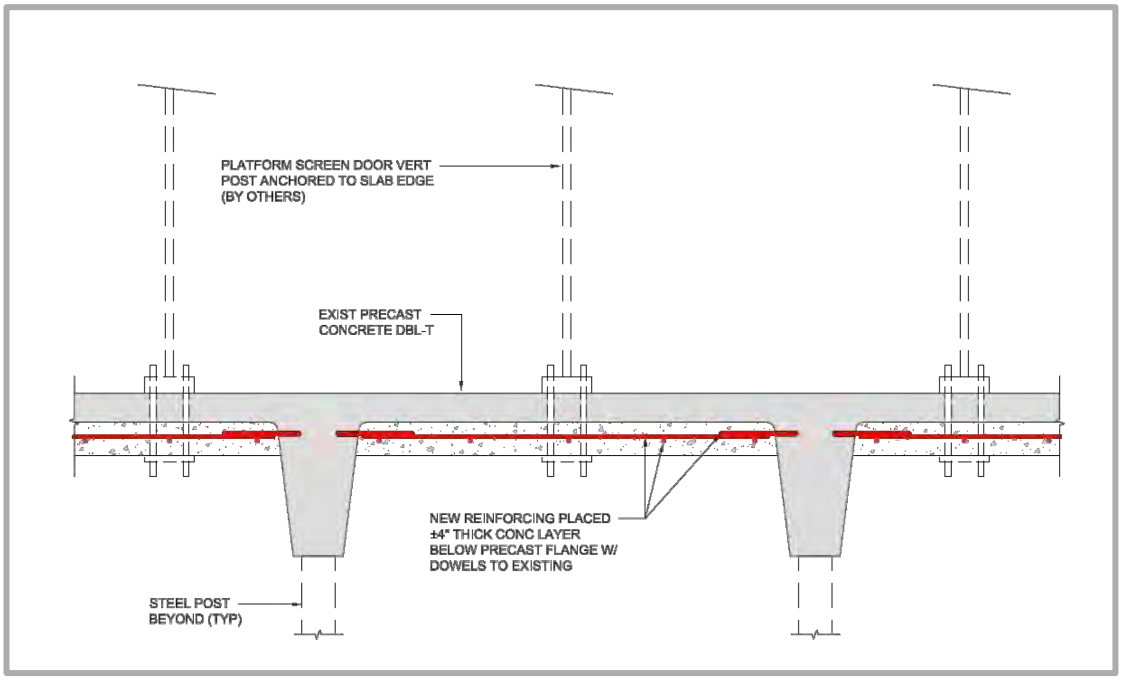


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5' – 11" of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis

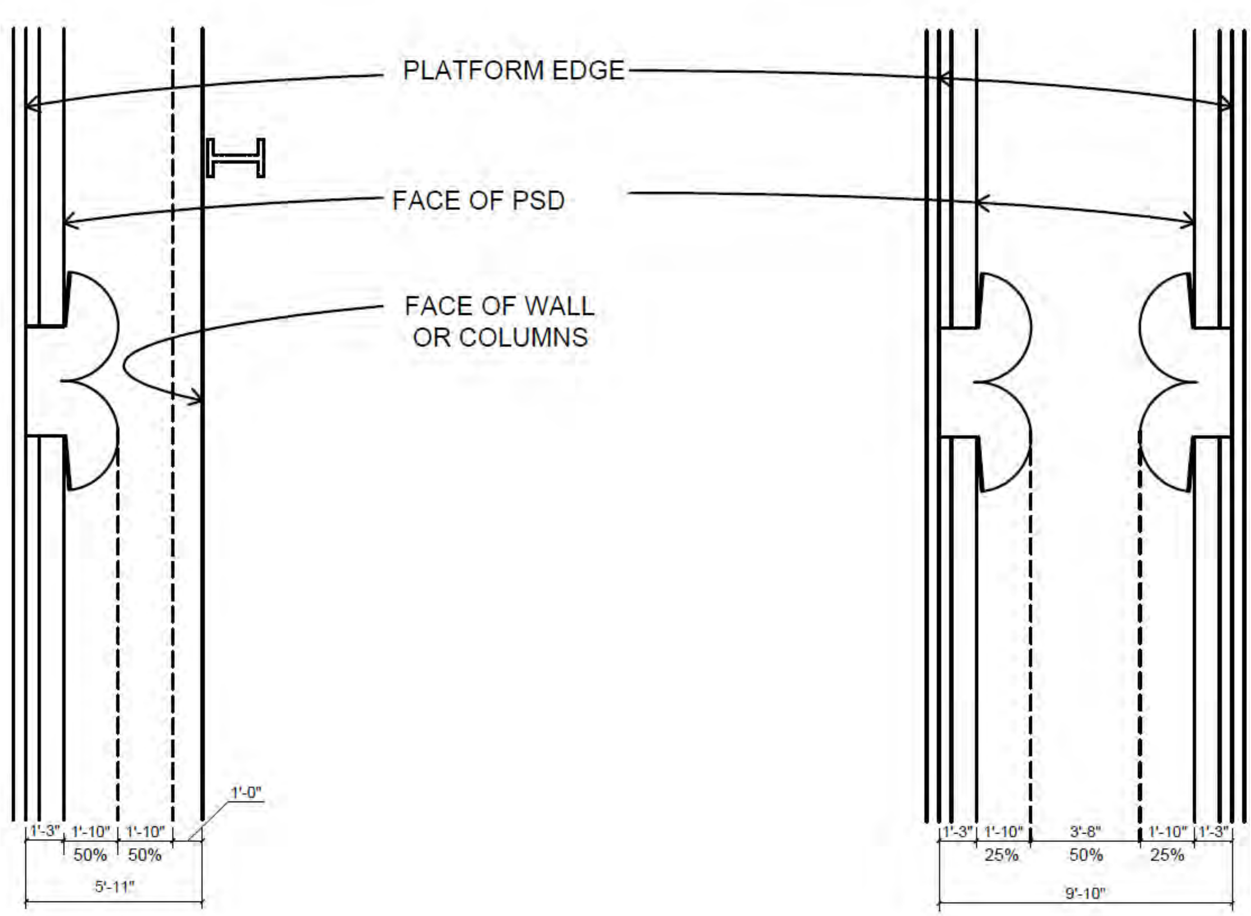


FIGURE 1: SIDE PLATFORM

FIGURE 2: CENTER PLATFORM

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE		EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800	per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the	9	$ 63,500	per month [Year 01]	$ 571,500		
	platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance	12	$ 83,590	per month [Year 02]	$ 1,003,080		
	since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	12	$ 65,683	per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000	per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5					
	Materials and labor for preventative maintenance and	12	$ 68,310	per month [Year 04]	$ 819,724		$ 819,724
	remedial repair performed as needed, 24/7, for the	12	$ 71,043	per month [Year 05]	$ 852,513		$ 852,513
	platform screen door system and ancillary equipment.						
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5					
	Repair and Replacement of Defective Hardware	24	$ 6,350	per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880	per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220	per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500	per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10					
	Repair and Replacement of Defective Hardware	60	$ 9,525	per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920	per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230	per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750	per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15					
	Repair and Replacement of Defective Hardware	60	$ 12,700	per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200	per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240	per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000	per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20					
	Repair and Replacement of Defective Hardware	60	$ 15,875	per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500	per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250	per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500	per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:		$ 6,078,826	$ 6,078,826	$ 7,619,663
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:		$ 7,619,663		

7	Labor Bill Rate (per hour)	Year 1	$ 238	per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248	per hour *	
		Year 3	$ 257	per hour *	
	Optional :	Year 4	$ 268	per hour *	
	Optional :	Year 5	$ 278	per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

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VJ ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL. (516) 932-1010

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations
ESTIMATE DATE:	April 11, 2019

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

MTA/NYCT

April 11, 2019

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.2 *APGs / PSDs will provide 29 emergency egress doors with push bars per platform*
1.3 *Each platform edge will have 40 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 It is assumed that each train has 10 cars on this line
2.2 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.3 In respect of the PSD option, only platforms that have not been upgraded in the recent past will require platform edge replacement.
2.4 There are no special security requirements made necessary by installation of the APG system
2.5 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.6 This estimate does not provide for the replacement of Platform Edge Lighting
2.7 Premium cost for night time work is considered 50% of total labor cost

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

MTA/NYCT

April 11, 2019

BASIS OF ESTIMATE

3.0 ***Exclusions - Costs not included in the estimate:***

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems
3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length
3.4 Costs associated with NYCT State Of Good Repair improvements to the station
3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.
3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs
3.7 Escalation Cost is not included; Anticipate at 5% per annum.
3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.
3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium
3.10 NYCT project cost is not included
3.11 GO and flagging cost is not included
3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or "soft" costs:***

4.1 Design and Construction Contingency
4.2 Contractor O & P
4.3 Insurance
4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 Given the limited time available, no drawings were developed to support this estimate.

MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

April 11, 2019

	ORDER OF MAGNITUDE COSTS		MRN 373	MRN 376	MRN 395	MRN 400	MRN 401
	DESCRIPTION		EAST 149TH STREET	BROOK AVENUE	103RD STREET	59TH STREET	51ST STREET
1	AUTOMATIC PLATFORM GATES (APG'S)		$14,431,402	$14,380,258	$14,643,536	$14,458,238	$14,495,691
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$14,431,402	$14,380,258	$14,643,536	$14,458,238	$14,495,691
4	GENERAL REQUIREMENTS	15.00%	$2,164,710	$2,157,039	$2,196,530	$2,168,736	$2,174,354
	SUB-TOTAL:		$16,596,113	$16,537,297	$16,840,067	$16,626,973	$16,670,044
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,149,028	$4,134,324	$4,210,017	$4,156,743	$4,167,511
	SUB-TOTAL:		$20,745,141	$20,671,621	$21,050,083	$20,783,717	$20,837,555
6	OVERHEAD & PROFIT	15.00%	$3,111,771	$3,100,743	$3,157,513	$3,117,557	$3,125,633
	SUB-TOTAL:		$23,856,912	$23,772,364	$24,207,596	$23,901,274	$23,963,189
7	BONDS & INSURANCE	3.75%	$894,634	$891,464	$907,785	$896,298	$898,620
	SUB-TOTAL:		$24,751,546	$24,663,828	$25,115,381	$24,797,572	$24,861,808
	SUBTOTAL CONSTRUCTION COST W/O ACM		$24,751,546	$24,663,828	$25,115,381	$24,797,572	$24,861,808
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		$24,751,546	$24,663,828	$25,115,381	$24,797,572	$24,861,808
10	DESIGN CONSULTANT FEES	10.00%	$2,475,155	$2,466,383	$2,511,538	$2,479,757	$2,486,181
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		$27,226,701	$27,130,211	$27,626,919	$27,277,329	$27,347,989
	ADD ALTERNATIVES						
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		$3,700,749	$3,666,857	$3,645,891	$4,146,010	$3,744,255
	Add for Markups (as above)	88.66%	3,281,191	3,251,141	3,232,552	3,675,973	3,319,765
	SUB-TOTAL PSD ALTERNATIVE		$6,981,941	$6,917,998	$6,878,443	$7,821,983	$7,064,020
	TOTAL PROJECT COST (PSD OPTION)		$34,208,642	$34,048,209	$34,505,362	$35,099,312	$34,412,009

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : EAST 149TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	534	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	526	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,060**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,060	LF	7	7,420
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,300	SF	12	63,600
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	107	CY	2,500	267,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,062	EA	25	26,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,062	EA	25	26,550
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,060	LF	95	100,700
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,060	LF	15	15,900
26	Remove existing platform tiles	1,060	LF	12	12,720
27	Sawcut existing topping concrete at perimeter of removal area	1,060	LF	5	5,300
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,360	SF	8	50,880
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width Approx. 12'-6" wide strip	520	SF	8	4,160
30	New Work				
31	New concrete topping to match existing	1,060	SF	15	15,900

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : EAST 149TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	520	SF	15	7,800
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,295	SF	750	1,721,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	199,335	199,335
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : EAST 149TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,060	LF	60	63,600
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : EAST 149TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,330,324	3,330,324
112					
113	TOTAL PSD WORK:				$ 14,431,402
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,814	SF	750	3,610,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	366,737	366,737
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	70,552
129	L6x6x1/2 continuous angle	8	TONS	17,500	136,528
130	Drilling and bolting - 4 bolts at each connection	424	EA	216	91,584
131	Platform Edge Repair				
132	Remove concrete platform edge	1,060	LF	27	28,620
133	Platform edge repair	1,060	LF	109	115,540
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	496	EA	10	4,960
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : EAST 149TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,295)	SF	750	(1,721,250)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	199,335	(199,335)
152	Platform Edge Reconstruction work	(1)	LS	499,400	(499,400)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,060)	LF	30	(31,800)
155					
156	Allow loss of production to work at night say 50%	1	LS	854,019	854,019
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 3,700,749

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : BROOK AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	525	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	525	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,051**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,051	LF	7	7,355
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,253	SF	12	63,040
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	106	CY	2,500	265,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,053	EA	25	26,317
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,053	EA	25	26,317
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,051	LF	95	99,813
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,051	LF	15	15,760
26	Remove existing platform tiles	1,051	LF	12	12,608
27	Sawcut existing topping concrete at perimeter of removal area	1,051	LF	5	5,253
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,304	SF	8	50,432
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width Approx. 12'-6" wide strip	520	SF	8	4,160
30	New Work				
31	New concrete topping to match existing	1,051	SF	15	15,760

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : BROOK AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	520	SF	15	7,800
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,253	SF	750	1,689,728
61	Spare Parts - Approx. 10% of Material Cost	1	LS	197,444	197,444
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : BROOK AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,051	LF	60	63,040
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : BROOK AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,318,521	3,318,521
112					
113	TOTAL PSD WORK:				$ 14,380,258
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,739	SF	750	3,554,235
126	Spare Parts - Approx. 10% of Material Cost	1	LS	363,374	363,374
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	69,942
129	L6x6x1/2 continuous angle	8	TONS	17,500	135,325
130	Drilling and bolting - 4 bolts at each connection	420	EA	216	90,777
131	Platform Edge Repair				
132	Remove concrete platform edge	1,051	LF	27	28,368
133	Platform edge repair	1,051	LF	109	114,522
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	496	EA	10	4,960
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : BROOK AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,253)	SF	750	(1,689,728)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	197,444	(197,444)
152	Platform Edge Reconstruction work	(1)	LS	495,873	(495,873)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,051)	LF	30	(31,520)
155					
156	Allow loss of production to work at night say 50%	1	LS	846,198	846,198
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 3,666,857

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : 103RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	550	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	550	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,100**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,100	LF	7	7,700
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,500	SF	12	66,000
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	111	CY	2,500	277,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,102	EA	25	27,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,102	EA	25	27,550
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,100	LF	95	104,500
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,100	LF	15	16,500
26	Remove existing platform tiles	1,100	LF	12	13,200
27	Sawcut existing topping concrete at perimeter of removal area	1,100	LF	5	5,500
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,600	SF	8	52,800
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10'-0" wide strip	320	SF	8	2,560
30	New Work				
31	New concrete topping to match existing	1,100	SF	15	16,500

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : 103RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	320	SF	15	4,800
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,475	SF	750	1,856,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	207,435	207,435
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : 103RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,100	LF	60	66,000
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : 103RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,379,278	3,379,278
112					
113	TOTAL PSD WORK:				$ 14,643,536
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,134	SF	750	3,850,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	381,137	381,137
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	73,165
129	L6x6x1/2 continuous angle	8	TONS	17,500	141,680
130	Drilling and bolting - 4 bolts at each connection	440	EA	216	95,040
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : 103RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,475)	SF	750	(1,856,250)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	207,435	(207,435)
152	Platform Edge Reconstruction work	(1)	LS	513,800	(513,800)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,100)	LF	30	(33,000)
155					
156	Allow loss of production to work at night say 50%	1	LS	841,359	841,359
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 3,645,891

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : 59TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	515	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	550	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,065**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,065	LF	7	7,455
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,325	SF	12	63,900
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	107	CY	2,500	267,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,067	EA	25	26,675
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,067	EA	25	26,675
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,065	LF	95	101,175
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,065	LF	15	15,975
26	Remove existing platform tiles	1,065	LF	12	12,780
27	Sawcut existing topping concrete at perimeter of removal area	1,065	LF	5	5,325
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,390	SF	8	51,120
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width Approx. 13'-0" wide strip	560	SF	8	4,480
30	New Work				
31	New concrete topping to match existing	1,065	SF	15	15,975

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : 59TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	560	SF	15	8,400
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,318	SF	750	1,738,125
61	Spare Parts - Approx. 10% of Material Cost	1	LS	200,348	200,348
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : 59TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,065	LF	60	63,900
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : 59TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,336,516	3,336,516
112					
113	TOTAL PSD WORK:				$ 14,458,238
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,854	SF	750	3,640,275
126	Spare Parts - Approx. 10% of Material Cost	1	LS	368,537	368,537
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	70,878
129	L6x6x1/2 continuous angle	8	TONS	17,500	137,172
130	Drilling and bolting - 4 bolts at each connection	426	EA	216	92,016
131	Platform Edge Repair				
132	Remove concrete platform edge	1,065	LF	27	28,755
133	Platform edge repair	1,065	LF	109	116,085
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	496	EA	10	4,960
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	80	HRS	162	12,960
137	Remove signal cables	600	LF	40	24,000
138	Remove conduit; Assuming 1"	600	LF	55	33,000
139	Install conduit in new position	600	LF	110	66,000
140	Install replacement cable; assumed single cable #12	600	LF	125	75,000
141	Re-commission / testing as required	2	EA	12,500	25,000
142	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
143	Premium Time	1,569	HRS	49	76,253
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : 59TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,318)	SF	750	(1,738,125)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	200,348	(200,348)
152	Platform Edge Reconstruction work	(1)	LS	499,950	(499,950)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,065)	LF	30	(31,950)
155					
156	Allow loss of production to work at night say 50%	1	LS	956,772	956,772
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,146,010

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : 51ST STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	534	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	534	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,067**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,067	LF	7	7,471
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,337	SF	12	64,040
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	108	CY	2,500	270,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,069	EA	25	26,734
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,069	EA	25	26,734
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,067	LF	95	101,397
21	Provide sleeves for HV & LV wires	248	EA	110	27,280
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,067	LF	15	16,010
26	Remove existing platform tiles	1,067	LF	12	12,808
27	Sawcut existing topping concrete at perimeter of removal area	1,067	LF	5	5,337
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,404	SF	8	51,232
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10' wide strip	520	SF	8	4,160
30	New Work				
31	New concrete topping to match existing	1,067	SF	15	16,010

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : 51ST STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	520	SF	15	7,800
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	360	LF	110	39,600
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	60	EA	15,000	900,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	10,500	609,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,328	SF	750	1,746,023
61	Spare Parts - Approx. 10% of Material Cost	1	LS	200,821	200,821
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	60	EA	2,500	150,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : 51ST STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,067	LF	60	64,040
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	250	LF	60	15,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	300	LF	60	18,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	180	EA	4,629	833,263
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	180	EA	5,566	1,001,802
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : 51ST STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,345,159	3,345,159
112					
113	TOTAL PSD WORK:				$ 14,495,691
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 3 Doors =30 No. per platform)	60	EA	25,000	1,500,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	58	EA	15,000	870,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,872	SF	750	3,654,315
126	Spare Parts - Approx. 10% of Material Cost	1	LS	369,379	369,379
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	71,031
129	L6x6x1/2 continuous angle	8	TONS	17,500	137,473
130	Drilling and bolting - 4 bolts at each connection	427	EA	216	92,218
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	40	HRS	162	6,480
137	Remove signal cables	300	LF	40	12,000
138	Remove conduit; Assuming 1"	300	LF	55	16,500
139	Install conduit in new position	300	LF	110	33,000
140	Install replacement cable; assumed single cable #12	300	LF	125	37,500
141	Re-commission / testing as required	1	EA	12,500	12,500
142	Engineering / Shop Drawings / Etc.	1	EA	7,500	7,500
143	Premium Time	785	HRS	49	38,151
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Train-6 Line Stations

11-Apr-19

STATION : 51ST STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 3 Doors = 30 No. per platform)	(60)	EA	15,000	(900,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #29 per Platform	(58)	EA	10,500	(609,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,328)	SF	750	(1,746,023)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	200,821	(200,821)
152	Platform Edge Reconstruction work	(1)	LS	502,707	(502,707)
153	Remove allowance for cast in sleeves for LV & HV power	(248)	EA	110	(27,280)
154	Conduit running under Platform Edge	(1,067)	LF	30	(32,020)
155					
156	Allow loss of production to work at night say 50%	1	LS	864,059	864,059
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 3,744,255

New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR '7' (FLUSHING) LINE STATIONS

CONTRACT #: C-32514 | STV PROJECT #: 3017214

FINAL SUBMITTAL DATE: July 23, 2018

STV 100 Years

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Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C
- A study of the entire Canarsie L-line

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations.

The Tier 1 analysis of door arrangement in the vehicles dedicated to the Flushing Line found that there are no problems of incompatibility; one train car type (R188) and one train consist will be run on the Flushing line for the foreseeable future (the assumed design year for this study is between 2018 and 2032). In addition, this will be the second line in the NYCT system to receive computer based train control (CBTC) enabling the stop location of the trains to be consistent. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

There are a total of 22 stations included in this study. Seven of the stations are below-grade and the remaining stations are elevated. Some of these stations have three tracks, offering express service or additional service related to specific events (in this case, Mets games). The stations are a mix of center/island and side platforms.

Of these 22 newly evaluated stations, 15 have been found to be not suitable for the installation of PSDs. The reasons for this finding vary but are generally related to space constraints and existing structure.

[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to low-height barriers]

The following summarizes the major findings:

- ADA clearance issues; the platform edge barriers are 15" wide. Where an existing object (wall, stair, railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Where these PSDs hamper the ability of a wheelchair to turn (a 5'-0" circle) and/or limit path of travel to less than 32", it is declared infeasible.
- Insufficient space for the PSD equipment room; the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 16'). Many stations do not have available space for these rooms.
- Platforms that are too narrow; due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements in regard to the placement of these new barriers in an existing station environment.

- Structural considerations; existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the wall and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is used at all stations on the Flushing "7" Line. For a PSD installation, It is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. As example, evidence of damage from these carts is readily visible along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process.

The table on the following page summarizes these findings, and shows that platform edge barriers are feasible at 32% of the "7" (Flushing) Line stations. Total implementation cost would be $283.0M for APGs and $353.3M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; That estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of $931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 7 feasible stations, the aggregate annual maintenance cost would be $6,517,000.

'7' (Flushing) Line Summary of Feasibility (32% feasible; 7/22)

No.	Station Name	Station Type	Platform Type	Feasible Yes / No	Issues / Reason for Failure	Cost APGs	Cost PSDs
MR-447	Flushing-Main Street	Below-grade	Center/Island	Yes		$60.0M	$75.2M
MR-448	Mets-Willets Point	Elevated	Side and Center/Island	Yes		$59.7M	$74.7M
MR-449	111th Street	Elevated	Side	No	• ADA clearance		
MR-450	103rd Street-Corona Plaza	Elevated	Side	No	• Precast platform (Appendix B)		
MR-451	Junction Boulevard	Elevated	Center/Island	No	• Precast platform (Appendix B)		
MR-452	90th Street-Elmhurst	Elevated	Side	No	• Precast platform (Appendix B)		
MR-453	82nd Street-Jackson Heights	Elevated	Side	No	• Precast platform (Appendix B)		
MR-454	74th Street-Broadway	Elevated	Center/Island	No	• Precast platform (Appendix B)		
MR-455	69th Street-Fisk Avenue	Elevated	Center/Island	No	• Precast platform (Appendix B)		
MR-456	61st Street-Woodside Avenue	Elevated	Side	No	• Precast platform (Appendix B)		
MR-457	52nd Street-Lincoln Avenue	Elevated	Center/Island	No	• Precast platform (Appendix B)		
MR-458	47th Street-Bliss Street	Elevated	Side	No	• ADA clearance		
MR-459	40th Street-Lowery Street	Elevated	Side	No	• ADA clearance		
MR-460	33rd Street- Rawson Street	Elevated	Side	No	• ADA clearance		
MR-461	Queensboro Plaza	Elevated	Center/Island	Yes		$32.8M	$41.3M
MR-462	Court Square	Elevated	Side	No	• No space for equipment room		
MR-463	Hunters Point Avenue	Below-grade	Side	No	• ADA clearance		
MR-464	Vernon Blvd-Jackson Ave	Below-grade	Side	Yes		$32.9M	$41.2M
MR-465	42nd Street-Grand Central	Below-grade	Center/Island	Yes		$33.1M	$41.5M
MR-466	5th Avenue-Bryant Park	Below-grade	Center/Island	No	• ADA clearance		
MR-467	42nd Street-Times Square	Below-grade	Center/Island	Yes		$31.4M	$38.8M
MR-471	34th Street-Hudson Yards	Below-grade	Center/Island	Yes		$33.1M	$40.6M
					Total Estimated Cost	$283.0M	$353.3M

1.0 Station Assessments

1.1 Flushing-Main Street Station

Summary: Flushing-Main Street (MR-447) is feasible for both APGs and PSDs. As a terminating station, Main Street Station serves Hudson Yards-bound local and express trains. Train signal boxes on tracks 1 and M, would have to be relocated in the implementation of PSDs. As the platform edge appears to be recently renovated, structural work would only be required in the implementation of APGs (see structural report; Appendix B). Existing power is adequate.

Description

Main Street Station is a below-grade station with two mildly curved center/island platforms. There are three tracks (Tracks 1, M, and 2). Track 1 is to the north of the station, track M is in the middle (accessed on both sides), and track 2 is to the south of the station. Track 1 is for the local train while Tracks M and 2 provide express service (see figure 1 for the station plan). Access from the mezzanine level to the platforms are provided at multiple locations along the platform length. The platform structure is cast-in-place concrete. Back-of-house elements are located at the ends of the platform and in the mezzanine. The columns on the east end of the platforms are larger due to their tile surround and are spaced 18'-0" on center, while remaining steel columns are 15'-0" on center. Typically, the platform widths are approximately 19'-0". Both platforms taper at their ends, the narrowest width is approximately 14'-4" wide (see figure 3 for a typical platform view). Generally, there is a vertical clearance of approximately 8'-0" to the ceiling at the platform edge. Train signal boxes that hang over the platform edge at track 1 and M, reduce the vertical clearance to 7'-2".

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Train signal boxes on tracks 1 and M would need to be relocated in the implementation of full height PSDs (see figure 4).

Half Height PSDs (aka APGs): This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Hung conduit below the platform edge would need to be coordinated to accommodate the requirements of the APG system.

Equipment Room

As there are four platform edges requiring platform edge barriers, there is a need for a larger equipment room. The equipment room can be located at the west-end of the mezzanine level with approximate dimensions of 14'-0" x 26'-6" (see figure 2).

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.`

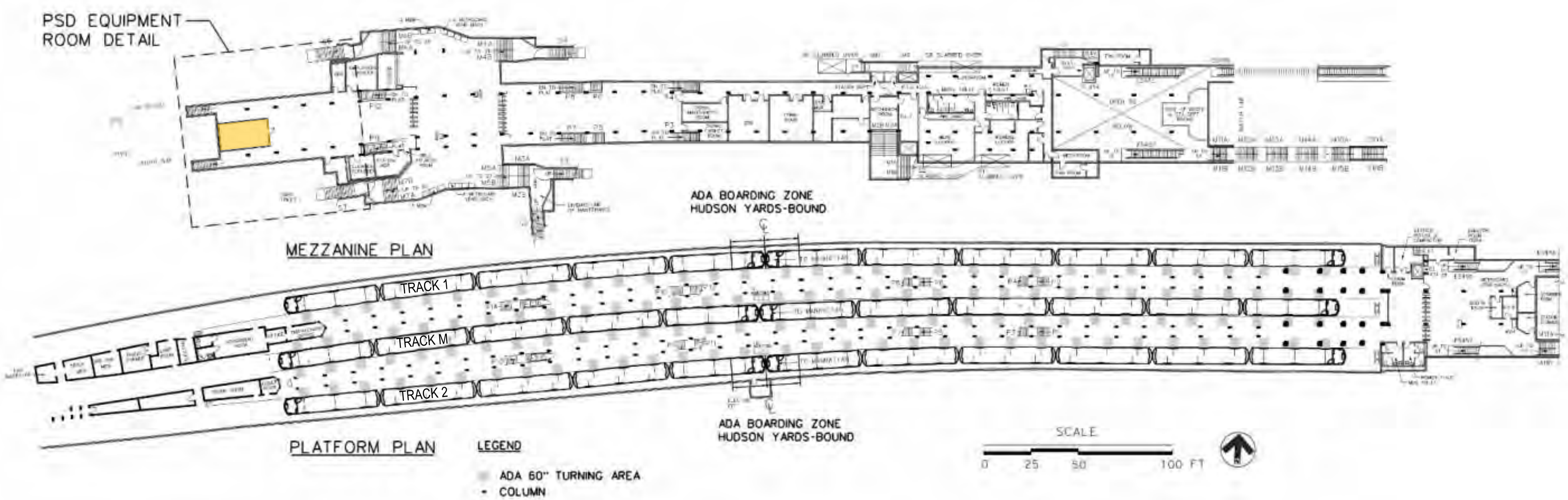

Figure 1 – Station Plan- Flushing-Main Street Station

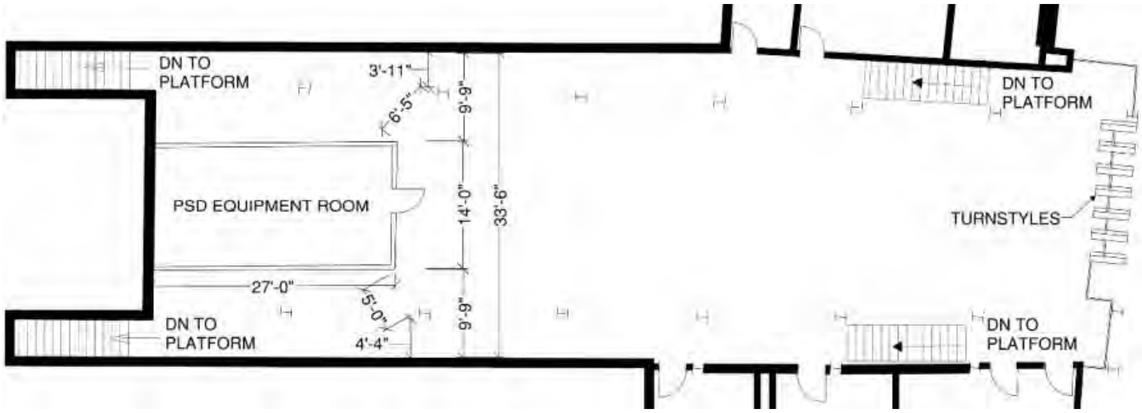

Figure 2 – PSD Equipment Room Detail – Flushing-Main Street Station

Platform Edge Condition

From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 3. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

Platform obstructions within 5' of edge:

Northern Platform: Typically, columns are approximately 5'-6" from the platform edge. At the east-end of the platform, eight columns are 17" from the platform edge.

Southern Platform: Typically, columns are approximately 5'-6" from the platform edge. At the east-end of the platform, four columns are 17" from the platform edge; additionally, four columns are 3'-0" from the platform edge.

The use of 22" emergency egress hinged doors is impeded by approximately 4 existing columns (total on all platforms). As there are so few emergency egress doors impeded by the atypical condition at the east-end of the platforms, this station is still feasible.

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge. Depending on the specific APG / PSD design used, there could be no or minimal alternations to the existing lighting configuration.

Power:

Power is adequate. See Electrical table on the following page. Calculation is based on APG loads which are the most demanding.

Flushing Line Station Electrical Capacity Analysis	
NYC T Station MR Number	447
Station Name	Flushing - Main St
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	142.4
Peak Demand Load, Max Current (A)	494.1
PSD Total Load for 64 Doors, including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	659
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	541
Electrical Service is Adequate or Not	Yes

Historic Restrictions:

Main Street Station is a historically designated property. As such, design will require review by the New York State Historical Preservation Office.

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $60.0M to install APGs and $75.2M to install PSDs (See Appendix E)

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Figure 3 – Typical platform view- Flushing-Main Street Station

Figure 4 – Signal box at platform edge with a vertical clearance of 7'-6" - Flushing-Main Street Station

1.2 Mets-Willets Point Station

Summary: Mets-Willets Point (MR-448) is feasible for both APGs and PSDs. Mets-Willets Point Station functions to accommodate users differently on game days and non-game days. To accommodate the surge in passengers, and to ensure that ADA routes are available on game days, additional tracks are used compared to a non-game day. Platform structural work would be required to support the added load of the platform edge barrier (see structural report; Appendix B). Existing power is adequate.

Description

Mets-Willets Point Station is an elevated station with three tracks serviced by two straight side and one center/island platform. The platforms are accessed at their centers with back-of-house elements below and at the ends of the platforms. Typically (non-game days), one side platform (track 1- Hudson Yards-bound) and the center platform (track 2- Flushing-Main Street-bound) are used. This station operates differently on game days to accommodate the many passengers arriving/departing from Citi Field. On game days, Track M accessed from the center/island platform runs additional Flushing-bound trains before the game and additional Hudson Yards-bound trains after the game. The side platform which is typically not used is opened on game days allowing for an ADA-accessible route to the stadium and mitigates large groups of passengers arriving at the station. If platform edge barriers were to be installed, they would be required at all four platform edges. See figure 1 for the Mets-Willets Point station plan. The platform structure is cast-in-place concrete. Along the length of all platforms, columns are typically spaced 20' on center. Both side platforms are approximately 22' wide. The center/island platform is approximately 24'-6 wide. About ¾ of the platform length is covered by a canopy. Typically, there is a vertical clearance of approximately 8'-0" to canopy beams at the platform edge (see figure 4 for a typical platform edge view).

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. As about ¼ of the platform length is not covered by an overhead structure, an overhead structure would be required to install full height PSDs.

Half Height PSDs (aka APGs): This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, entrapment prevention sensors may be ceiling-mounted or on the APG unit itself. In any case, there will be CCTV cameras over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Wall-mounted conduit below the platform edge would need to be relocated to accommodate the requirements of the APG system. Minimal overhead structure would be needed to accommodate cameras and sensors in the small portion of the platforms not covered by canopies.

Equipment Room

As there are four platform edges requiring platform edge barriers, two full equipment rooms are required. These rooms can be located at the west-end of both side platforms. Both rooms would measure approximately 27'-0" x 7'-6" (see figures 2 and 3)

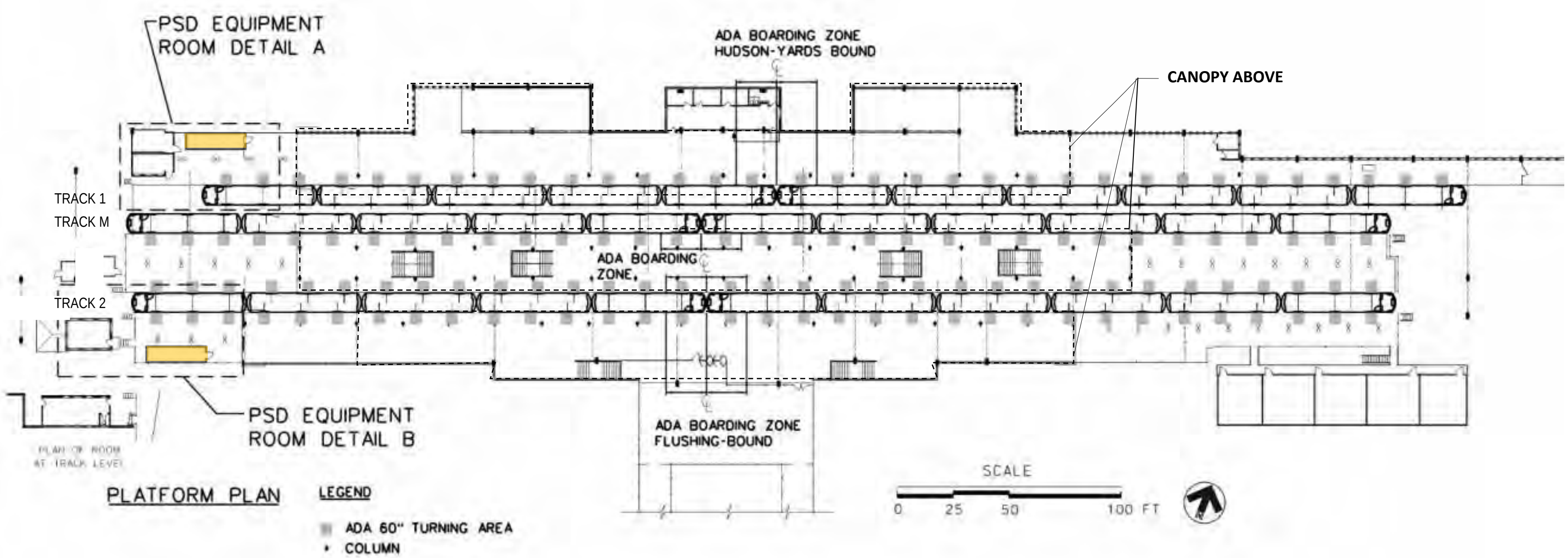

Figure 1 – Station Plan- Mets-Willet Point Station

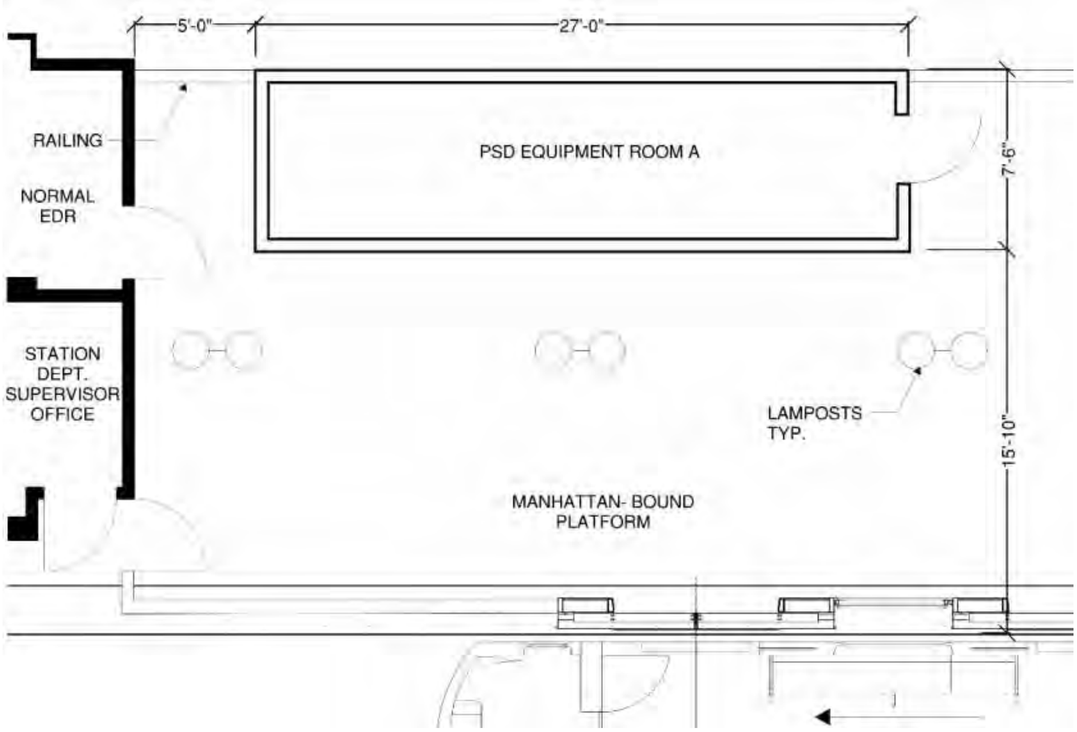

Figure 2 – PSD Equipment Room A Detail – Mets-Willets Point Station

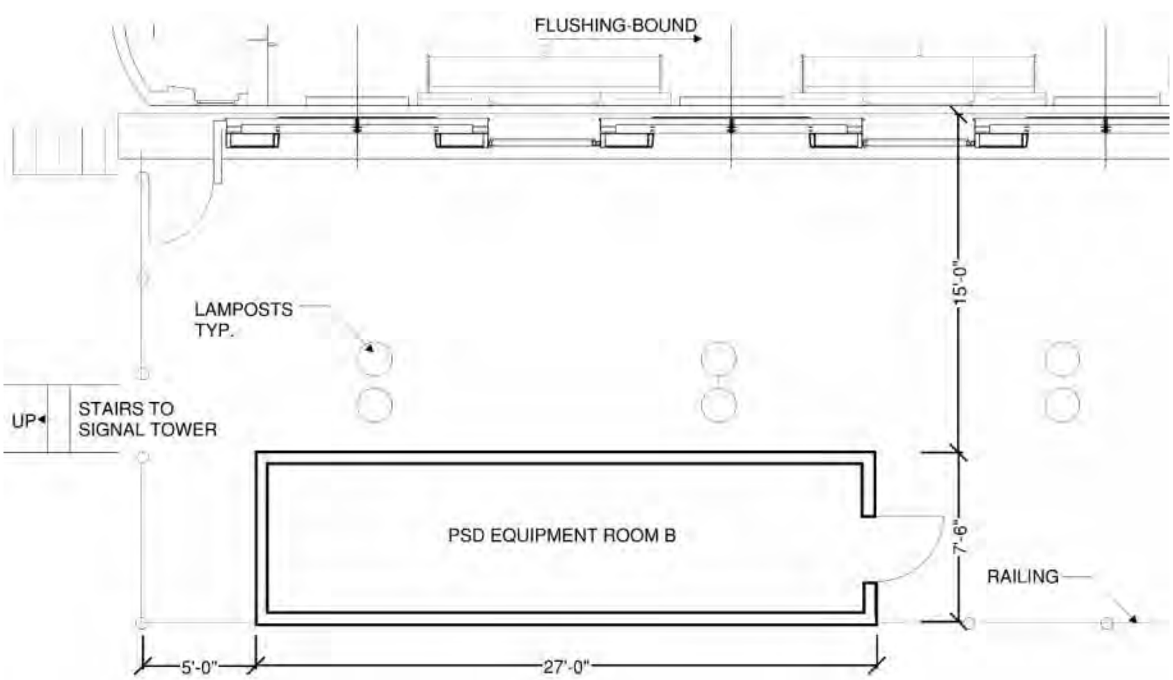

Figure 3 – PSD Equipment Room B Detail - Mets-Willets Point Station

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would be required for the installation of a PSD or APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 2.75. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

Platform obstructions within 5' of edge:

Flushing-bound (side platform): Column faces are typically 4'-4' from the platform edge. There are no obstructions at the ADA-designated doors

Center/Island Platform: Column faces are approximately 6'-0" from the platform edge. There are no obstructions at the ADA-designated doors

Hudson Yards-bound (side platform): Same as Flushing-bound conditions (see above).

Figure 4 – Typical platform view- Mets-Willets Station

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge with a vertical clearance of 7'-0". Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

Power is adequate. See Electrical table below. Calculation is based on APG loads which are the most demanding.

Flushing Line Station Electrical Capacity Analysis	
NYC T Station MR Number	448
Station Name	Mets - Willets Point
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	117.6
Apparent Power (kVA)	147.0
Peak Demand Load, Max Current (A)	408.0
PSD Total Load for 64 Doors, including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	573
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	627
Electrical Service is Adequate or Not	Yes

Historic Restrictions:

None.

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $59.7M to install APGs and $74.7M to install PSDs (See Appendix E)

1.3 111th Street Station

Summary: 111th Street Station (MR-449) is not feasible for APGs or PSDs as they would create non-compliant ADA conditions. The stairs at this station align with the back of the platform and typically leave a clear path of 3'-4" for circulation along the length of the platform. This condition currently complies with ADA requirements. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA compliant wheelchair movement would not be met as the remaining circulation width would only be 25" (see figure 1)

Description

111th Street Station is an elevated station with straight side platforms. The platform structure is cast-in-place concrete. The platform widths vary slightly, but range from 7'-0" to approximately 10'-6". There are three staircases on each platform. Passengers currently walk in the clear space between the stair and platform edge (3'-4") to move along the length of the platform (see figures 1 and 2). Approximately 4/5 of the platform is covered by a canopy.

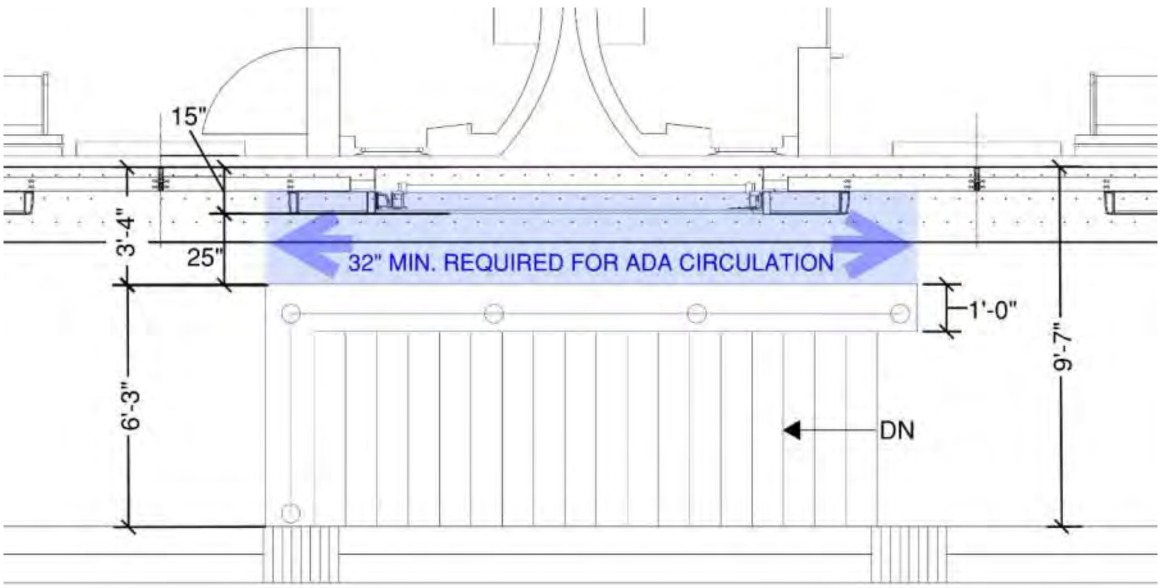

Figure 1– Typical platform condition at stairs – 111th Street Station

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Figure 2 – Typical stair location and platform condition – 111th Street Station

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1.4 103rd Street-Corona Plaza Station

Summary: 103rd Street-Corona Plaza Station (MR-450) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2).

Description

103rd Street-Corona Plaza Station is an elevated station with two side platforms. Both platforms are straight with columns along the length of the platform supporting the canopy. The canopy covers about 2/3 of the station, with parts of the station uncovered at both ends (see figure 1). If the station was deemed feasible, an overhead structure would be required to install a platform edge barrier where there is currently no canopy.

Figure 1 – Typical platform condition – 103rd Street-Corona Plaza Station

Figure 2 – Precast T-Beam platform – 103rd Street-Corona Plaza Station

1.5 Junction Boulevard Station

***Summary:** Junction Boulevard Station (MR-451) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2).*

Description

Junction Boulevard Station is an elevated station with two center/island platforms. Both platforms are straight with columns along the platform. The canopy covers about half of the station (see figure 1). If the station was deemed feasible, an overhead structure would be required to install a platform edge barrier where there is currently no canopy.

Figure 1– Typical platform condition – Junction Boulevard Station

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Figure 2 – Precast T-Beam platform – Junction Boulevard Station

1.6 90th Street-Elmhurst Street Station

Summary: 90th Street-Elmhurst Street Station (MR-452) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2).

Description

90th Street-Elmhurst Street Station is an elevated station with two side platforms. Both platforms are straight with columns along the length of the platform supporting the canopy. The canopy covers about half of the platform (see figure 1). If the station was deemed feasible, an overhead structure would be required to install a platform edge barrier where there is currently no canopy.

Figure 1 – Typical platform view (much of platform is not covered by a canopy) – 90th Street-Elmhurst Street Station

Figure 2 – Precast T-Beam platform – 90th Street-Elmhurst Street Station

1.7 82nd Street-Jackson Heights Station

Summary: 82nd Street-Jackson Heights Station (MR-453) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2).

Description

82nd Street-Jackson Heights Station is an elevated station with two side platforms. Both platforms are straight with columns along the platform supporting the canopy. The canopy covers about half of the station, with parts of the station uncovered at both ends (see figure 1).

Figure 1 – Considerable Portion of the Platform Not Covered – 82nd Street-Jackson Heights Station

Figure 2 – Precast T-Beam platform – 82nd Street-Jackson Heights Station

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1.8 74th Street-Broadway Station

Summary: 74th Street-Broadway Station (MR-454) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2).

Description

74th Street-Broadway Station is an elevated station with two side platforms. Both platforms are straight with columns along the platform supporting the canopy. The canopy covers the majority of the platform length. See figure 1 for a typical platform view.

Figure 1–Typical Platform Condition – 74th Street- Broadway Station

Figure 2–Precast T-Beam Platform – 74th Street- Broadway Station

1.9 69th Street-Fisk Avenue Station

Summary: 69th Street-Fisk Avenue Station (MR-454) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2).

Description

69th Street-Fisk Avenue Station is an elevated station with two side platforms. Both platforms are straight with columns along the platform supporting the canopy. The canopy covers about half of the station, with parts of the station uncovered at both ends (see figure 1).

Figure 1 – Considerable Portion of Platform Not Covered – 69th Street-Fisk Avenue Station

Figure 2 –Precast T-Beam Platform – 69th Street-Fisk Avenue Station

1.10 61st Street-Woodside Avenue Station

***Summary:** 61st Street-Woodside Avenue Station (MR-456) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2).*

Description

61st Street-Woodside Avenue Station is an elevated station with two island/center platforms. Both platforms are straight with columns along the platform supporting the canopy. The canopy covers the majority of the station. See figure 1 for a typical platform view.

Figure 1– Typical Platform Condition – 61st Street-Woodside Avenue Station

Figure 2– Precast T-Beam Platform – 61st Street-Woodside Avenue Station

1.11 52nd Street-Lincoln Avenue Station

Summary: 52nd Street-Lincoln Avenue Station (MR-457) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2).

Description

52nd Street-Lincoln Avenue Broadway Station is an elevated station with two side platforms. Both platforms are straight with columns along the platform supporting the canopy. The canopy covers the majority of the station. See figure 1 for a typical platform view.

Figure 1 – Typical platform condition – 52nd Street-Lincoln Avenue Station

Figure 2 – Precast T-Beam platform – 52nd Street-Lincoln Avenue Station

1.12 46th Street-Bliss Street Station

Summary: 46th Street- Bliss Street Station (MR-458) is not feasible for APGs or PSDs as they would create non-compliant ADA conditions. The stairs at this station align with the back of the platform and typically leave a clear path of 3'-4" for circulation along the length of the platform. This condition currently complies with ADA requirements. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA compliant wheelchair movement would not be met as the remaining circulation width would only be 25" (see figure 1)

Description

46th Street-Bliss Street Station is an elevated station with straight side platforms. The platform structure is cast-in-place concrete. The platform widths vary slightly, but range from 7'-0" to approximately 10'-6". There are four staircases on each platform. Passengers currently walk in the clear space between the stair and platform edge (3'-4") to move along the length of the platform (see figures 1 and 2). Approximately 2/3 of the platform is covered by a canopy.

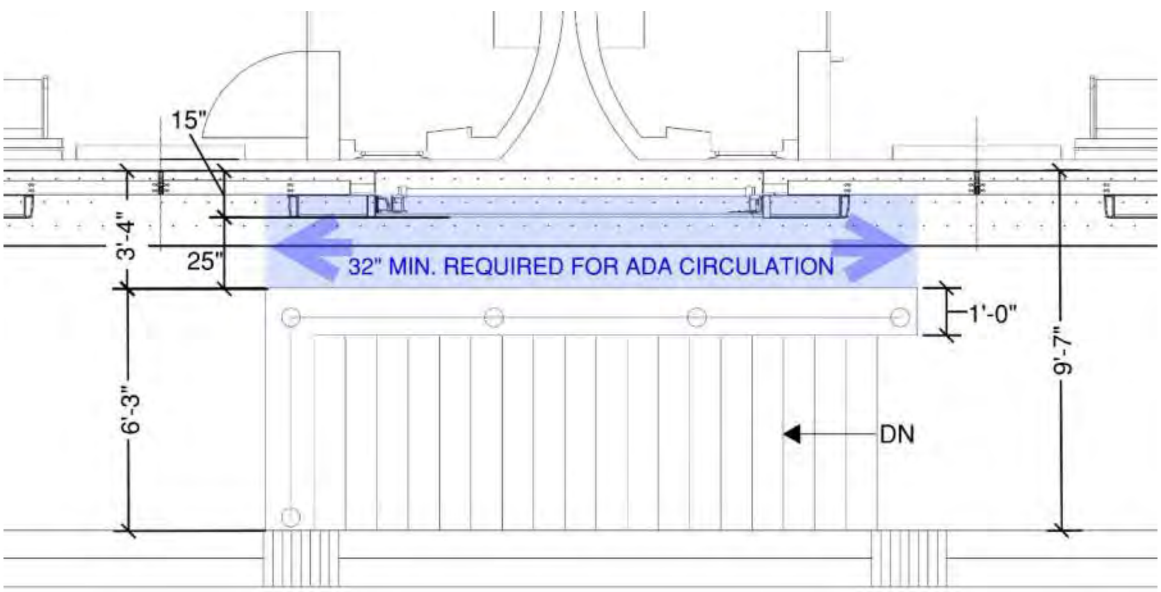

Figure 1 – Typical platform condition at stairs – 46th Street-Bliss Street Station

Figure 2 – Typical stair location and platform condition – 46th Street-Bliss Street Station

1.13 40th Street-Lowery Street Station

Summary: 40th Street-Lowery Street Station (MR-459) is not feasible for APGs or PSDs as they would create non-compliant ADA conditions. The stairs at this station align with the back of the platform and typically leave a clear path of 3'-4" for circulation along the length of the platform. This condition currently complies with ADA requirements. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA compliant wheelchair movement would not be met as the remaining circulation width would only be 25" (see figure 1)

Description

40th Street-Lowery Street Station is an elevated station with straight side platforms. The platform structure is cast-in-place concrete. The platform widths are approximately 9'-7". There are two staircases on each platform. Passengers currently walk in the clear space between the stair and platform edge (3'-4") to move along the length of the platform (see figures 1 and 2).

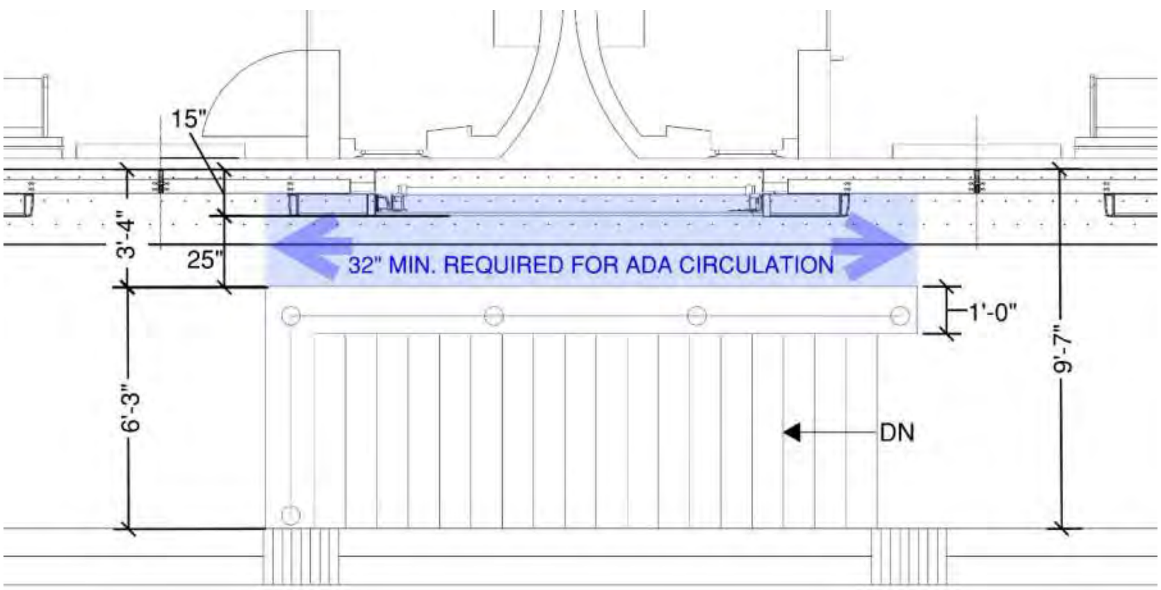

Figure 1– Typical platform condition at stairs – 40th Street-Lowery Street Station

Figure 2 – Typical stair location and platform condition – 40th Street-Lowery Street Station

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1.14 33rd Street- Rawson Street Station

Summary: 33rd Street- Rawson Street Station (MR-460) is not feasible for APGs or PSDs as they would create non-compliant ADA conditions. The stairs at this station align with the back of the platform and typically leave a clear path of 3'-4" for circulation along the length of the platform. This condition currently complies with ADA requirements. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA compliant wheelchair movement would not be met as the remaining circulation width would only be 25" (see figure 1).

Description

33rd Street- Rawson Street Station is an elevated station with straight side platforms. The platform structure is cast-in-place concrete. The platform widths vary slightly, but range from 6'-0" to approximately 9'-7". There are four staircases on each platform. Passengers currently walk in the clear space between the stair and platform edge (3'-4") to move along the length of the platform (see figures 1 and 2).

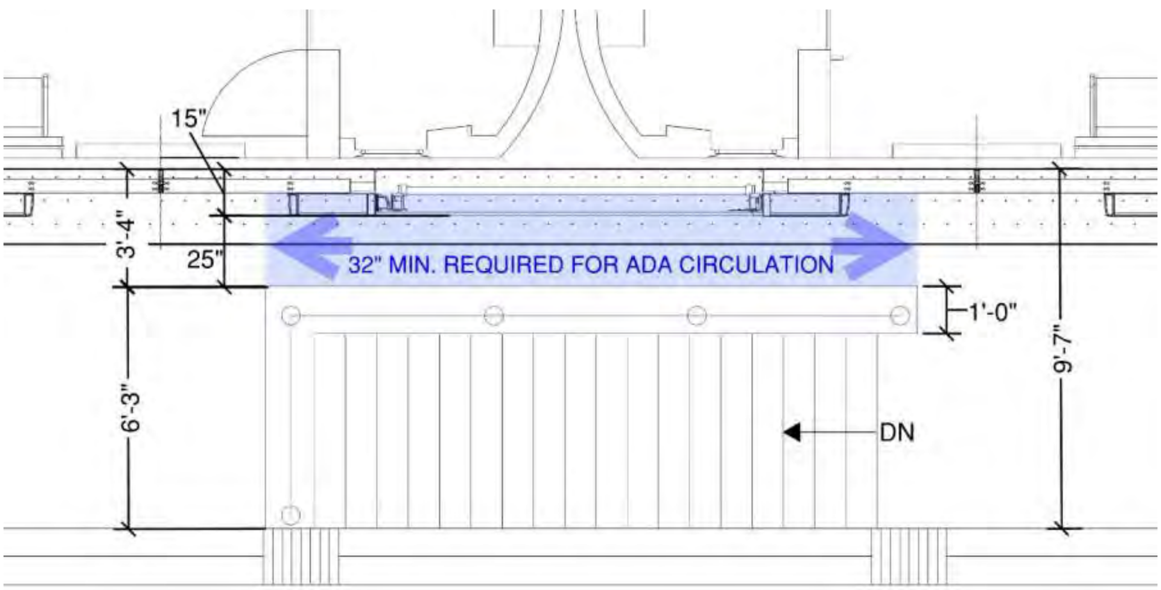

Figure 1– Typical platform condition at stairs – 33rd Street- Rawson Street Station

Figure 2 – Typical stair location and platform condition –33rd Street- Rawson Street Station

1.15 Queensboro Plaza Station

Summary: Queensboro Plaza Station (MR-461) is feasible for both APGs and PSDs. The "7", "N" and "W" trains are served on both the upper & lower levels, with the 7 train and N/W trains on opposite sides of the island platforms. The N/W sides of these platforms will be the subject of a future station report. There is a column in front of an ADA-designated door on both the upper & lower level platforms which is currently not compliant; this condition would not be exacerbated in the implementation of a platform edge barrier. The vertical clearance at the platform edge on both platforms is only 7'-2" in isolated locations. This is a potential obstacle for the installation of full height PSDs. Platform structural work will be required to support an APG system (see structural report; Appendix B). Existing power is adequate.

Description

Queensboro Plaza Station is elevated with two straight center/island platforms stacked on top of each other. Both platforms are accessed via an elevated mezzanine below the lower platform (southbound trains). See figure 1 for an overall station plan. Both platforms are made of cast-in-place concrete. Back-of-house elements are situated at the mezzanine level and both ends of the southbound platform. On the southbound platform, columns are spaced 48' on center with column faces 4'-8" from the platform edge. On the northbound platform, columns are spaced 24' on center with column faces 2'-2" from the platform edge. Both platforms are approximately 19'-6" wide. On the southbound platform, there is a vertical clearance of approximately 8'-0", which reduces to 7'-2" at the east-end of the platform. On the northbound platform, there is a vertical clearance of approximately of 7'-2" to canopy beams at the platform edge. The majority of the upper platform is covered by a canopy. See figures 3 and 4 for typical platform edge conditions at both levels.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. As about 1/6 of the upper level platform length is not covered by an overhead structure, an overhead structure would be required to install full height PSDs.

Half Height PSDs (aka APGs): This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, entrapment prevention sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be CCTV cameras over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Wall mounted conduits below the upper and lower platform edge would need to be relocated to accommodate the requirements of the APG system. Minimal overhead structure would be needed to accommodate cameras and sensors in the small portion of the platforms not covered by canopies

Equipment Room

One room can be accommodated at the eastern end of the southbound platform. The proposed room would measure approximately 27' x 7'-6" (see figure 2). As there are four platform edges at this station, two equipment rooms would be needed to accommodate all of the required equipment. An additional room can be located in a similar location on the northbound platform.

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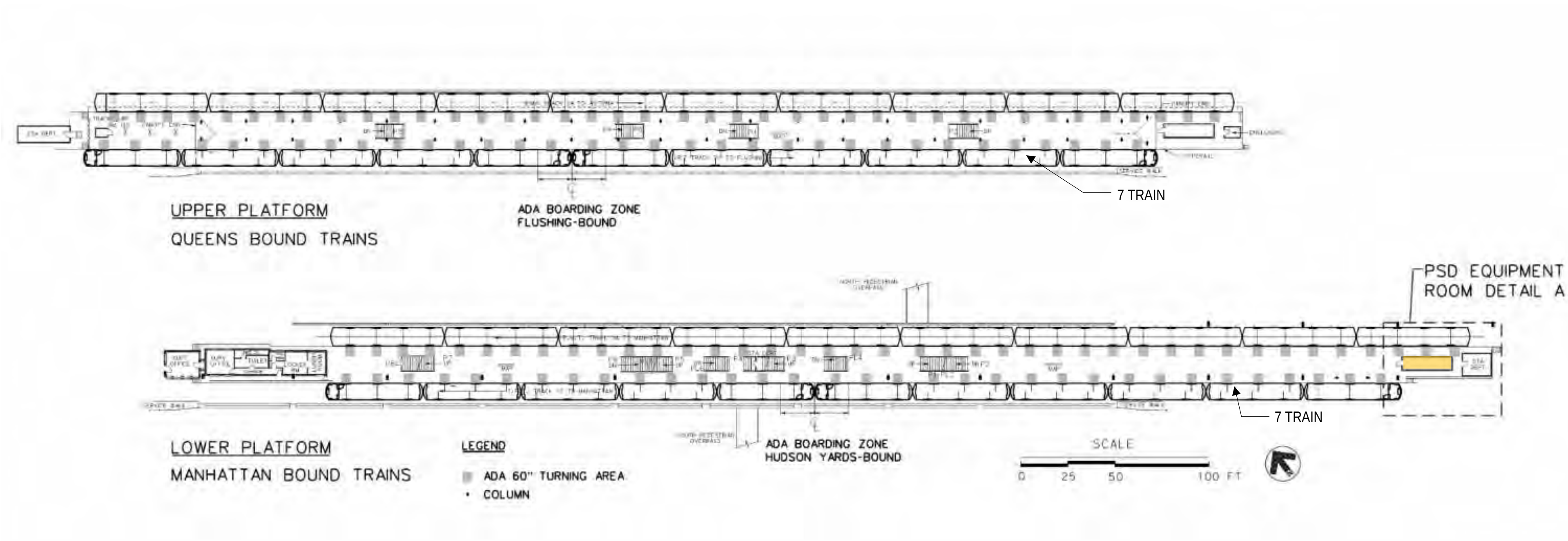


Figure 1 – Station Plan- Queensboro Plaza Station

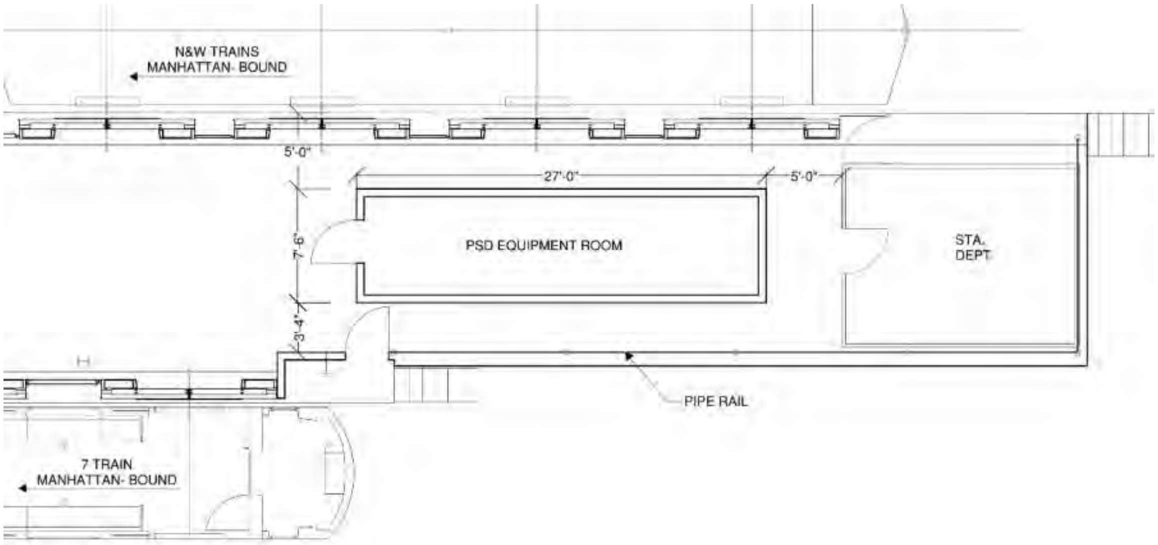


Figure 2 – PSD Equipment Room Detail - Queensboro Plaza Station

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 2.6. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

Platform obstructions within 5' of edge:

Hudson Yards-bound (Southbound): All columns are 26" from the Hudson Yards platform edge. One is in front of an ADA-designated door, however the implementation of a platform edge barrier would not exacerbate this already non-compliant condition.

Flushing-bound (Northbound): All columns are 51" from the platform edge. One column is in front of an ADA-designated door, however critical ADA dimensions are met.

Lighting:

Existing lighting: Linear fluorescent; approximately 1' from platform edge for southbound and centered under canopy on the northbound platform. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

Power is adequate. See Electrical table on the following page. Calculation is based on APG loads which are the most demanding.

Flushing Line Station Electrical Capacity Analysis	
NYC T Station MR Number	461
Station Name	Queensboro Plaza
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	163
Apparent Power (kVA)	204
Peak Demand Load, Max Current (A)	566
PSD Total Load for 64 Doors, including All Miscellaneous Loads, (A)	165
Total Load (Station Peak + PSD), (A)	731
Station Service Power Capacity, (A)	1,200
Service Spare Capacity, (A)	469
Electrical Service is Adequate or Not	Yes

Historic Restrictions:

None.

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station (the two 7 line edges and one equipment room) is estimated to be $32.8M to install APGs and $41.3M to install PSDs (See Appendix E).

Figure 3 – Typical northbound platform edge- Queensboro Plaza Station

Figure 4– Typical southbound platform edge- Queensboro Plaza Station

1.16 Court Square Station

Summary: *Court Square Station (MR-462) is not feasible for APGs or PSDs as there is not enough area to adequately locate a PSD equipment room(s). Generally at side platform stations, equipment rooms can either be accommodated at the ends of the platforms, in back-of-house areas, or at the mezzanine level. At Court Square, the train length is as long as the platform, so a room cannot be located at the north-end of the platforms. The south end of the platforms provide connections to other lines in addition to accommodating back-of-house elements. Additionally, the mezzanine level is fully utilized and highly trafficked. Another obstacle at this station is the platform structure which is made of Fiber-Reinforced Polymer planks. Complex modifications would be required in order to allow for the installation of a PSD system.*

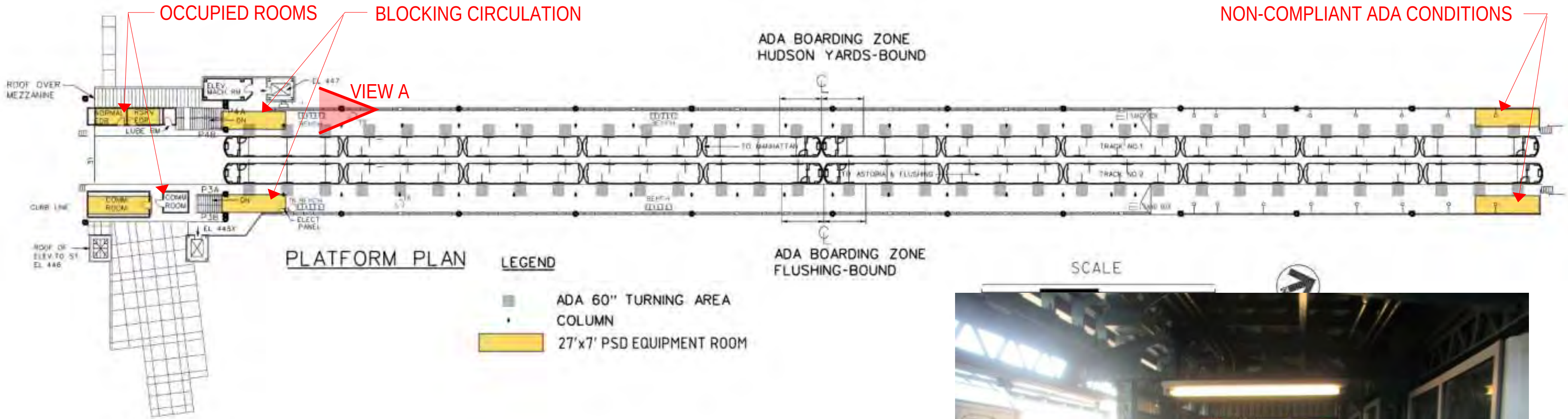
Description

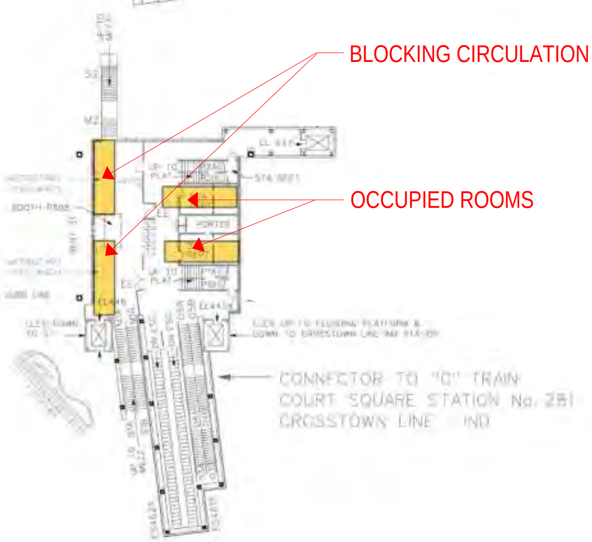
Court Square Station is an elevated station with straight side platforms. Court Square Station is a historically designated property. Typically, the platforms are approximately 12'-0" wide. The lack of space to accommodate an equipment room eliminates Court Square as a feasible station (see figure 1 on the following page).

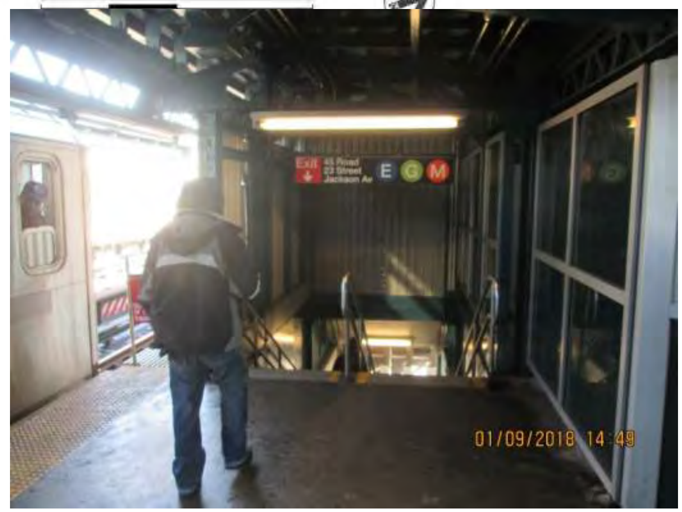
Fiber-Reinforced Polymer (FRP) Structure

The platform consists of a series of prefabricated FRP planks spanning perpendicular to the tracks with a cantilevered platform edge, similar to the precast concrete platforms found at elevated stations throughout the System. The FRP planks have been installed recently and are quite robust structurally. It is likely that the planks have sufficient strength to support the added weight and applied loads of a PSD system, however there would be challenges in the installation of a PSD system. Installation of the PSDs will likely require the addition of a steel or FRP edge member between the ribs of the planks in order to continuously support the PSD. The added member will also allow the PSD system to be thru-bolted to the planks and provide resistance to torsion at the edge of the cantilever. Installation of the edge member will be challenging, as the working clearances between the platform and the girder below will restrict the size of the member, tools, and equipment. The installation of conduits for power and communications would also be required. Holes for the conduits would have to be drilled through the FRP planks so the cables can be routed below the platform edge. The location of these holes must be compatible with both the FRP planks (i.e. they cannot pass through the ribs), as well as the PSD system itself, which presents a coordination challenge.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for ‘7’ (Flushing) Line Stations
(Court Square Station)







VIEW A: SOUTH-END OF PLATFORM (HUDSON-YARDS-BOUND)
CIRCULATION TO EXIT AND CONNECTIONS

Figure 1– Overall Plan highlighting lack of space for an equipment room – Court Square Station

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1.17 Hunters Point Avenue Station

Summary: Hunters Point Avenue Station (MR-463) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. Columns toward the platform edge which flank the stairs are 3'-6" away from the platform edge. At the stairs on the Flushing-bound platform, the 32"minimum requirement for ADA compliant wheelchair movement would not be met as the remaining circulation width would only be 27" (see figure 1).

Description

Hunters Point Avenue Station is a below-grade station with straight side platforms. The platform structures are cast-in-place concrete. Access to the station upper mezzanine is available only at the east-end of the platforms. Platform widths vary, but are typically about 12'-0" wide. Typically, columns are spaced 15' on center approximately 3'-6" away from the platform edge. Currently at the stairs on the Flushing-bound platform, passengers walk in the clear space between the columns and the platform edge (3'-6") which complies with ADA requirements. See figure 2 for the location of this non-compliant condition at Hunters Point Avenue Station.

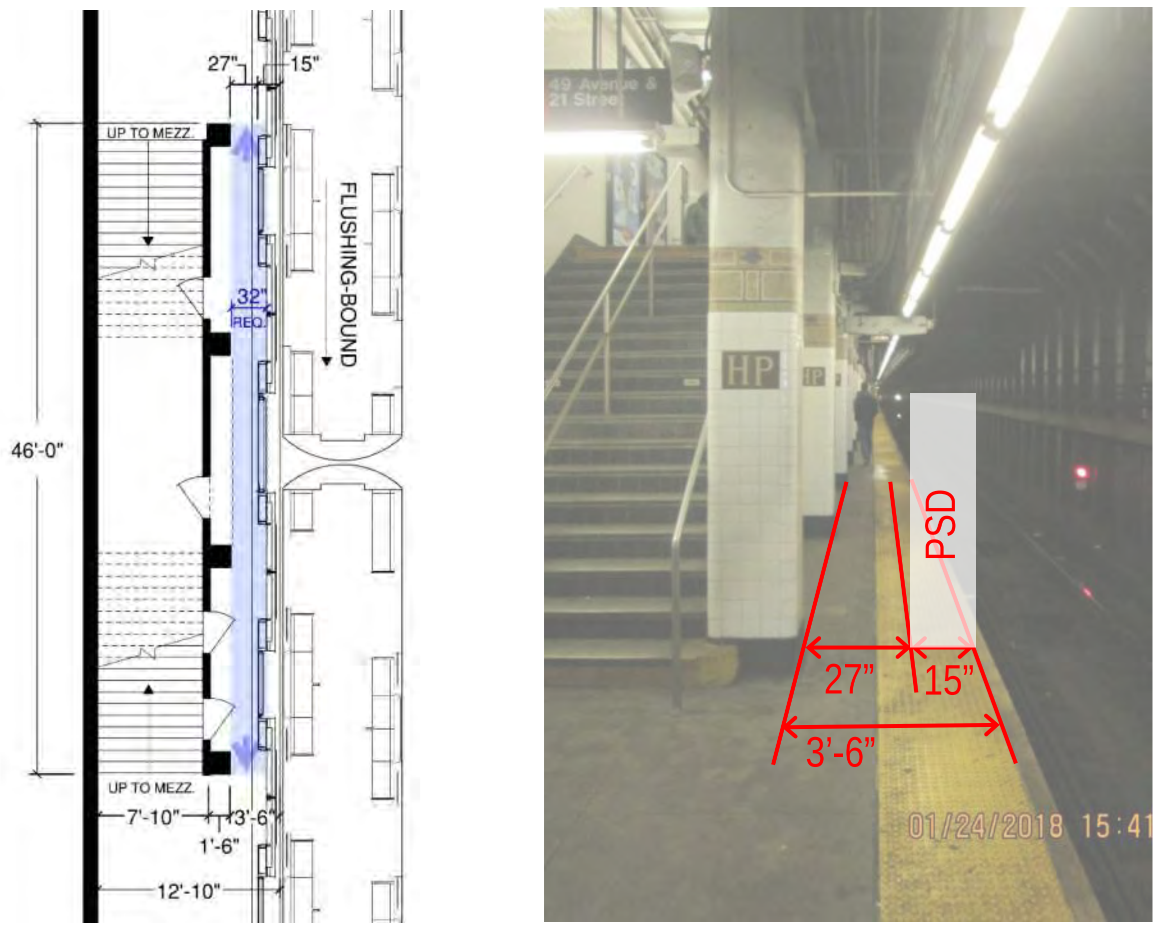

Figure 1 –ADA constraint at Flushing-bound stairs and photo of condition- Hunters Point Avenue Station

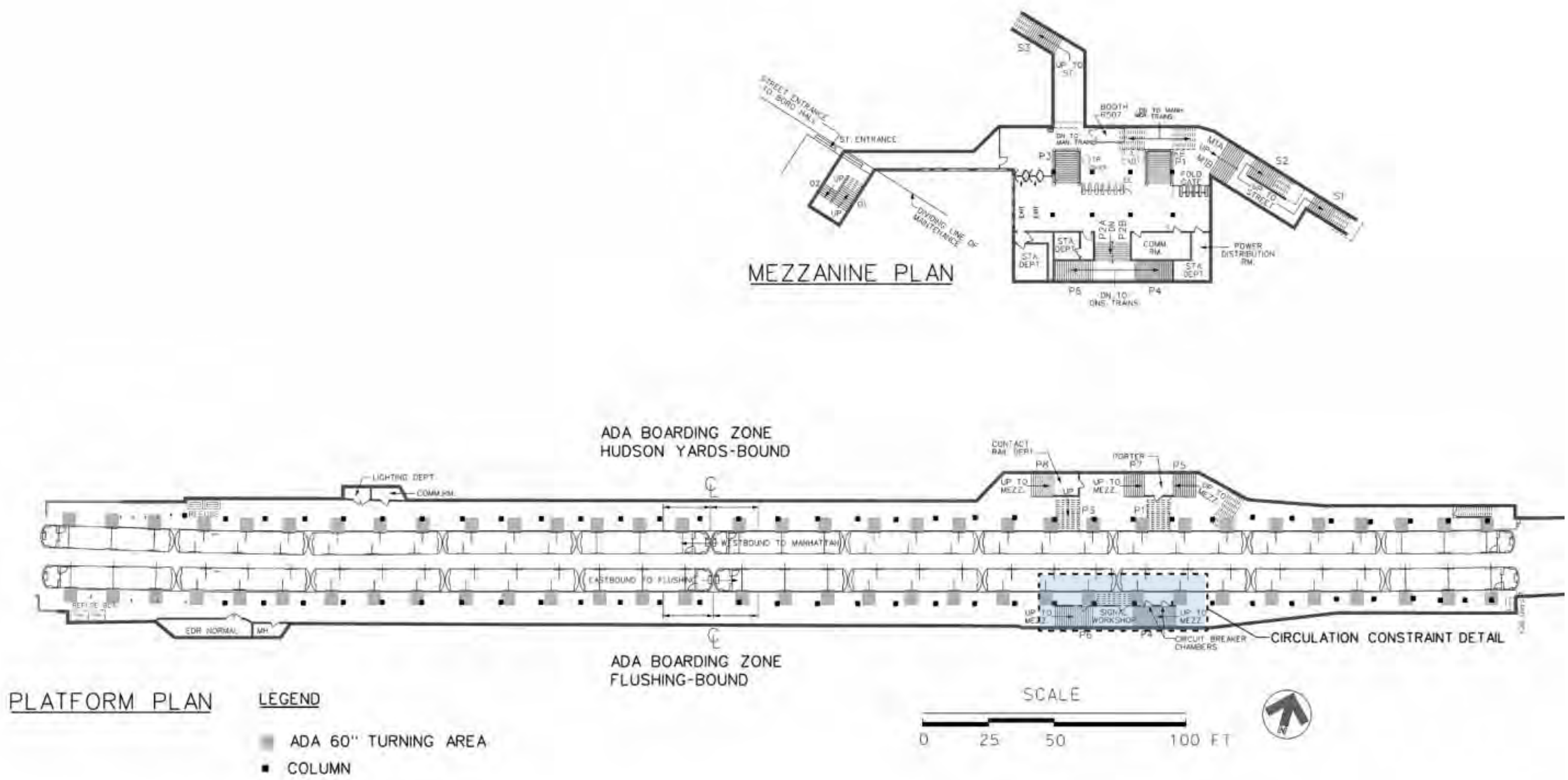

Figure 3 – Station Plan- Hunters Point Avenue Station

1.18 Vernon Boulevard-Jackson Avenue Station

***Summary:** Vernon Boulevard-Jackson Avenue Station (MR-464) is feasible for both APGs and PSDs. On both platforms, there is a column in front of an ADA-designated door. These existing non-compliant conditions would not be exacerbated in the implementation of a platform edge barrier. As the platform edge has been recently renovated, platform structural work would only be required for an APG system (see structural report; Appendix B). Existing power is adequate.*

Description

Vernon Boulevard-Jackson Avenue Station is a below-grade station with straight side platforms. The platforms are made of cast-in-place concrete and can be accessed from the street. For a plan of Vernon Boulevard-Jackson Avenue Station, see figure 1. Back-of-house elements are placed primarily on the eastern end of the platform or in the control areas. The platforms are approximately 11'-0" wide with columns spaced 15'-0' on center. Column faces are typically 4'-0" from the edge of the platform. Ceiling heights range from 8'-6" to 9'-6" at the edge of the platform. There are multiple conduits over the platform edges, with a larger number at and beyond the Hudson Yards-bound platform edge. See figure 3 for a typical platform view at this station.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, entrapment prevention sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be CCTV cameras over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. There is conduit below the Flushing-bound platform edge that would need to be coordinated to accommodate the requirements of the APG system.

Equipment Room

One room can be located at the east-end of the station at the Flushing-bound Jackson Avenue entry. There is a large landing within the paid area that is a few steps above the platform level. There is currently a barricade in this location, the equipment room measuring approximately 7' x 27' can be accommodated in its place (see figure 2).

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 1.5. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

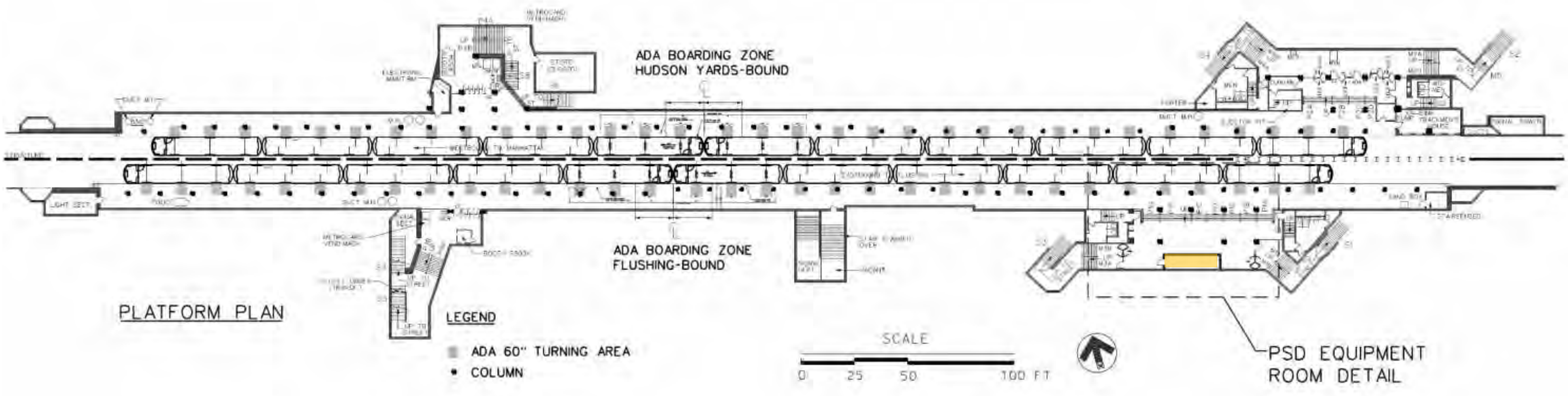

Figure 1 – Station Plan- Vernon Blvd.- Jackson Ave. Station

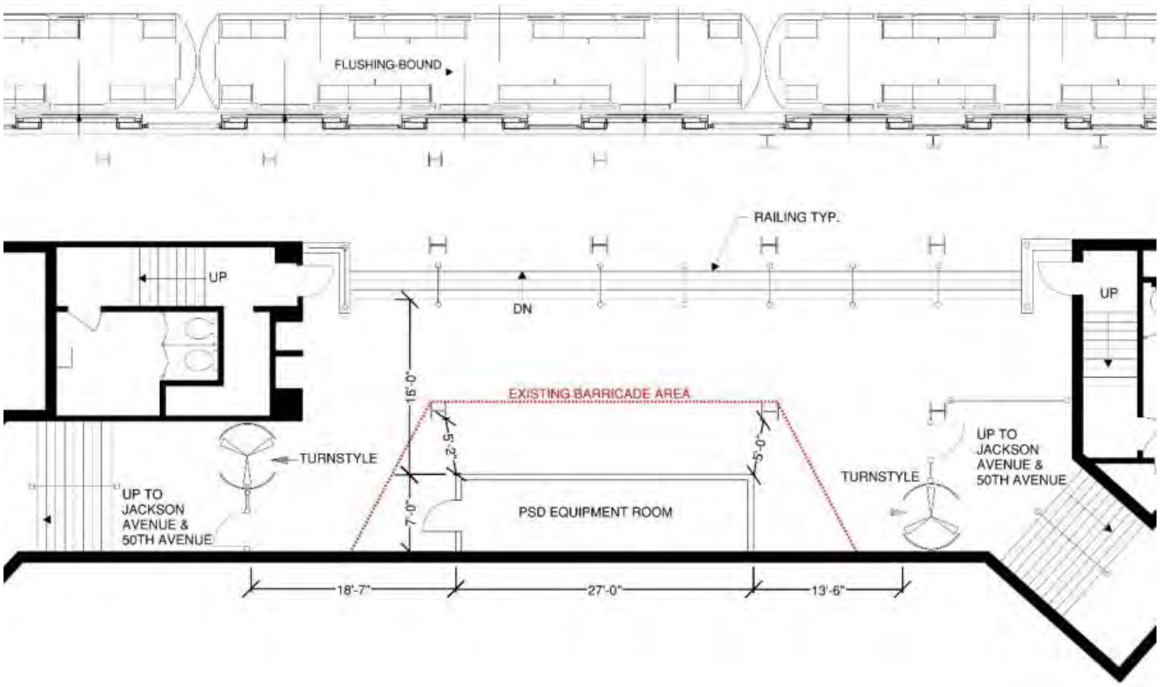

Figure 2 – PSD Equipment Room Detail - Vernon Blvd.- Jackson Ave. Station

Platform obstructions within 5' of edge:

Hudson Yards-bound: Most columns are 48" from the platform edge, however there are a few that are 24" from the platform edge. One column is in front of an ADA-designated door, however the implementation of a platform edge barrier would not exacerbate this already non-compliant condition.

Flushing-bound: Most columns are 48" from the platform edge, however there are a few that are 24" from the platform edge. One column is in front of an ADA designated door, however the implementation of a platform edge barrier would not exacerbate this already non-compliant condition.

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

Power is adequate. See Electrical table on the following page. Calculation is based on APG loads which are the most demanding.

Flushing Line Station Electrical Capacity Analysis	
NYC T Station MR Number	464
Station Name	Vernon Blvd - Jackson Ave
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	160
Apparent Power (kVA)	200
Peak Demand Load, Max Current (A)	555
PSD Total Load for 64 Doors, including All Miscellaneous Loads, (A)	165
Total Load (Station Peak + PSD), (A)	720
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	80
Electrical Service is Adequate or Not	Yes

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.9M to install APGs and $41.2M to install PSDs (See Appendix E).

Figure 3 –Typical Platform Condition- Vernon Blvd.- Jackson Ave. Station

1.19 42nd Street-Grand Central Station

Summary: 42nd Street-Grand Central Station (MR-465) is feasible for both APGs and PSDs. There is an existing non-compliant ADA condition at one of the ADA-designated doors on the Hudson Yards-bound platform. This existing non-compliant conditions would not be exacerbated in the implementation of a platform edge barrier. There are a few ceiling-mounted conduits which follow the full arch of the ceiling, extending over both tracks. The locations of the conduits would have to be coordinated in the implementation of full height PSDs. As the platform edge has been recently renovated, platform structural work would only be required for an APG system (see structural report; Appendix B). It is assumed that existing power is adequate.

Description

42nd Street-Grand Central Station is a below-grade station with one center/island platform (see figure 1 for a plan of the station). The Hudson Yards-bound track is straight, while the Flushing-bound track is slightly curved at the west-end of the station. The platform structure is made of cast-in-place concrete. The platform is accessed from an upper level Mezzanine. Back-of-house elements are located at either end of the platform and on the mezzanine level. The platform is column free with the exception of four columns against the centrally located stairs towards the Hudson Yards-bound platform edge. The platform width varies, but typically is approximately 18'-6" wide. The ceiling is arched with a vertical clearance of 12'-0" at the platform edge.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. As noted in the summary, ceiling-mounted conduit would have to be coordinated or rerouted as they extend over the full span of the station (see figure 4).

Half Height PSDs (aka APGs): This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, entrapment prevention sensors may be ceiling-mounted or on the APG unit itself. In any case, there will be CCTV cameras over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Both hung and wall-mounted conduits below the platform edge would need to be relocated to accommodate the requirements of the APG system.

Equipment Room

An equipment room can be accommodated at the west-end of the platform. The proposed room dimension is 27'-0" x 7'-6" (see figure 2).

Track Layout

The Hudson Yards-bound track is tangent. The Flushing-bound tack is mostly tangent, but is mildly curved and the west-end of the station. Thus, we are only expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs at the west-end of the Flushing-bound track. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

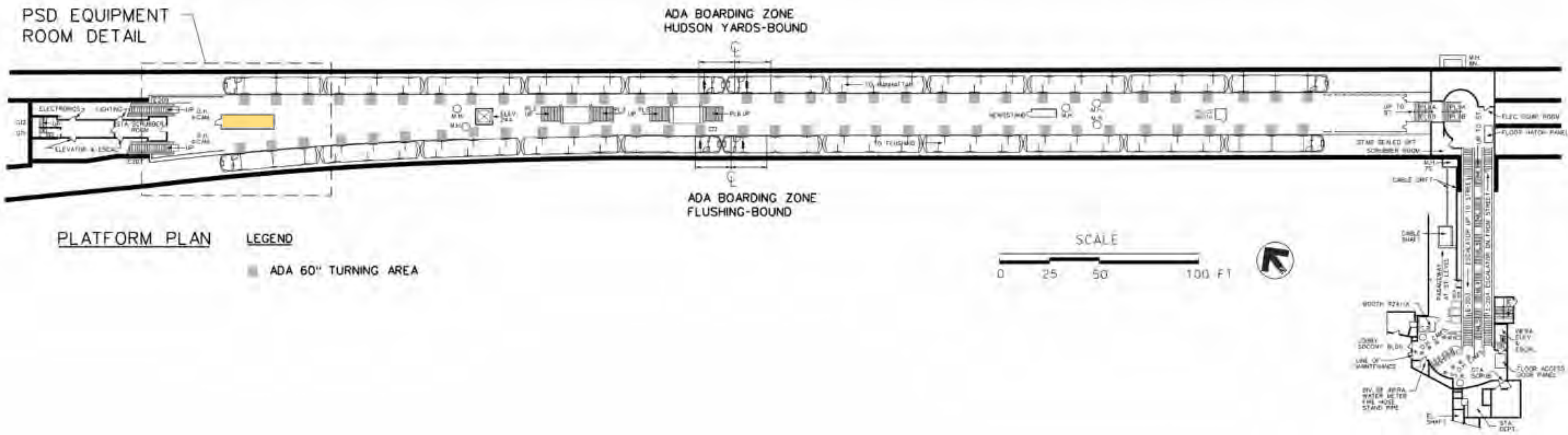

Figure 1 – Station Plan- 42nd Street- Grand Central Station

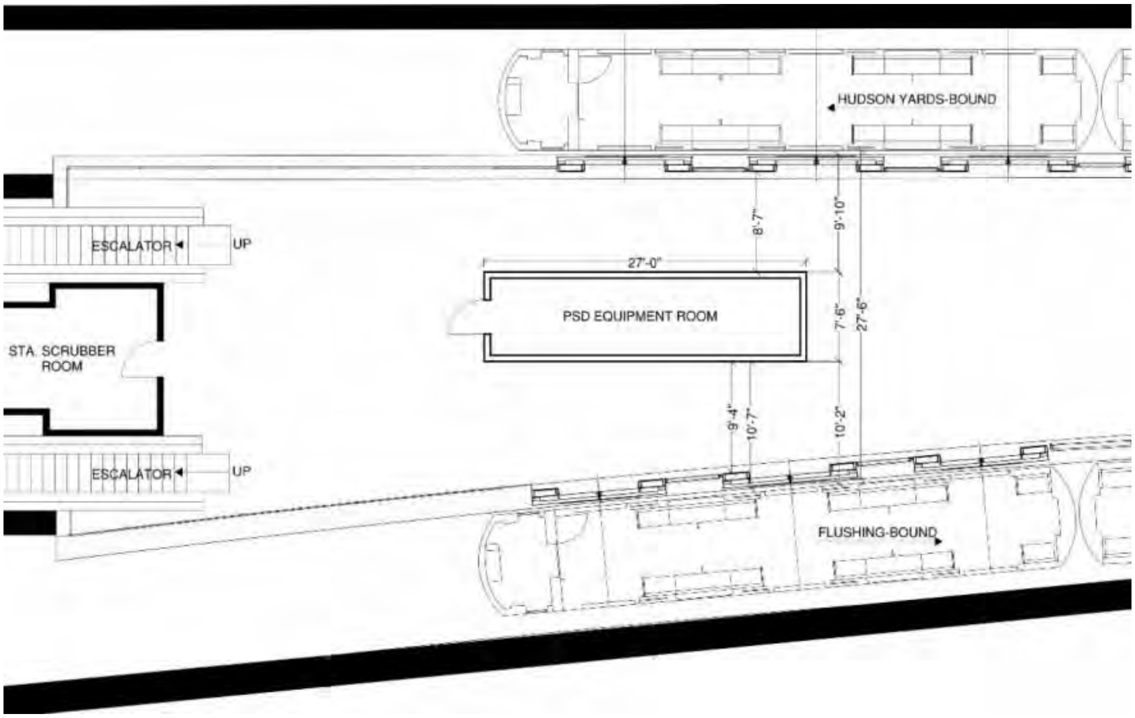

Figure 2 – PSD Equipment Room Detail – 42nd Street- Grand Central Station

Platform edge condition

From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 3. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

Platform obstructions within 5' of edge:

Hudson Yards-bound: The four centrally located stairs are 5'-4" away from the platform edge, with columns 4'-7" away from the platform edge. One of these columns is in front of an ADA-designated door, however the implementation of a platform edge barrier would not exacerbate this existing non-compliant condition.

Flushing-bound: None

Lighting:

Existing lighting: In some locations, linear fluorescent lighting is used and is located approximately 24" from platform edge (see figure 3). Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration. At other parts of the station, lighting is further away from the platform edge and arranged forming diamond shapes at the middle part of the platform (see figure 4).

Power:

This information was not ascertainable at the time of the survey. However, we do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $33.1M to install APGs and $41.5M to install PSDs (See Appendix E).

Figure 3 – Typical platform view adjacent to central stairs – 42nd Street- Grand Central Station

Figure 4– Typical platform view looking towards the end of the platform ends – 42nd Street- Grand Central Station

1.20 5th Avenue-Bryant Park Station

Summary: *5th Avenue-Bryant Park Station (MR-466) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. Columns toward the platform edge which flank the stairs are 3'-10" away from the platform edge. At all stairs along the length of the platform, the 32" minimum requirement for ADA compliant wheelchair movement would not be met as the remaining circulation width would be 31" (see figure 1). At the stairs, clearances along both platform edges would not comply with the required minimums.*

Description

5th Avenue-Bryant Park Station is a below-grade station with a slightly curved center/island platform. The cast-in-place concrete platform is accessed by 5 centered stairways and one stairway on the western end of the platform (see figure 2). Column spacing along the platform is approximately 15' on center with column faces 3'-10" to the edge of the platform. The platform is approximately 17'-8" wide, but tapers to a narrow 9'-2" at the east-end of the platform. Currently at all stairs along the length of the platform, passengers walk in the clear space between the columns and the platform edge (3'-10") which complies with ADA requirements. The implementation of a platform edge barrier would result in non-compliant ADA conditions that would not allow for ADA compliant wheelchair movement along the length of the platform.

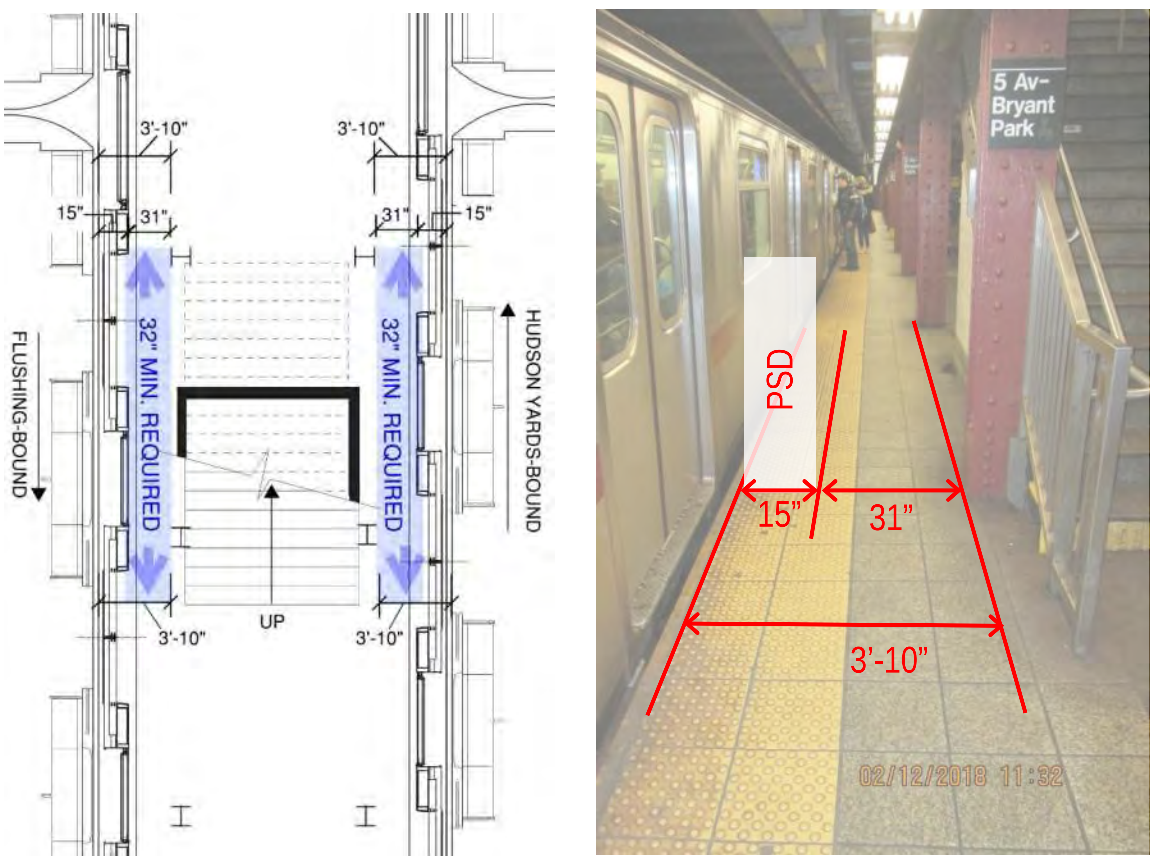

Figure 1 – Typical constraint at all stairs and photo of existing conditions- 5th Avenue-Bryant Park Station

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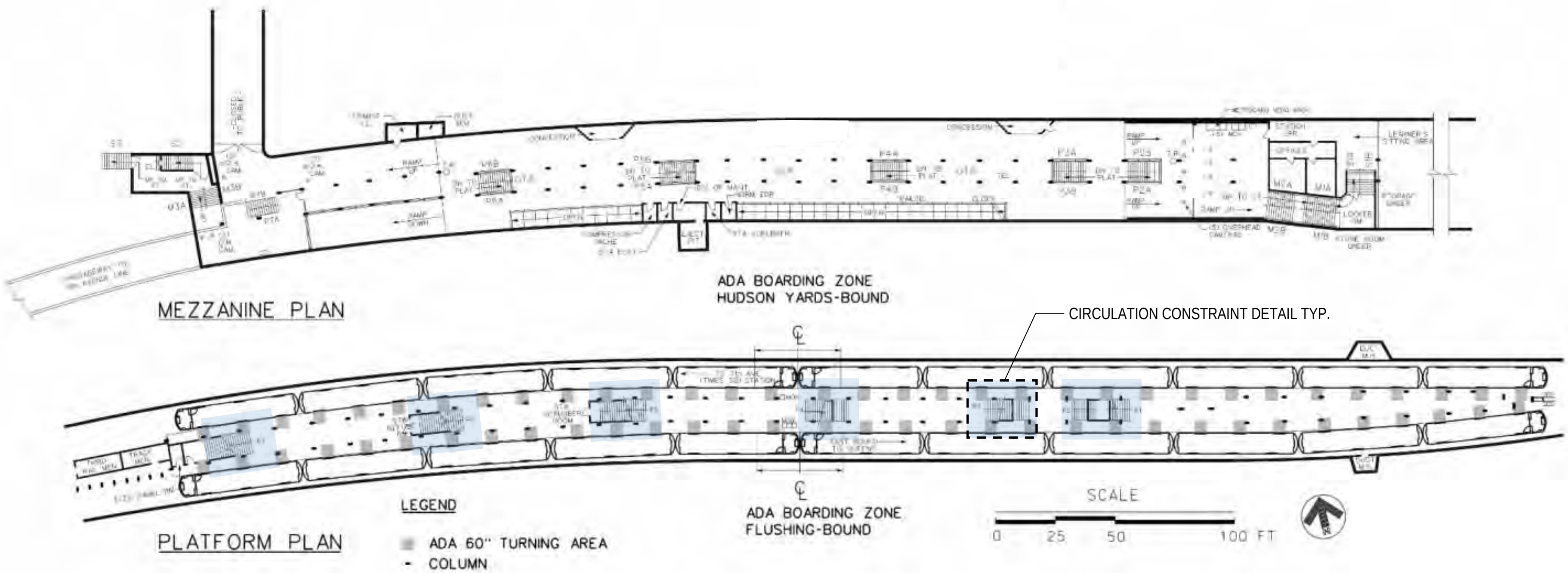

Figure 2 – Station Plan- highlighting constrained areas at all stairs- 5th Avenue-Bryant Park Station

1.21 42nd Street-Times Square Station

Summary: 42nd Street-Times Square (MR-467) is feasible for both APGs and PSDs. At both platform edges, there is one train signal box with a vertical clearance less than 7'-0" which would have to be relocated in the implementation of a full height PSD system. As the platform edge has been recently renovated, platform structural work would only be required for an APG system (see structural report; Appendix B). Existing power is adequate.

Description

42nd Street-Times Square Station is a below grade station with a straight center/island platform. The cast-in-place concrete platform is accessed at various locations along the length of the platform. Back-of-house elements are located at the ends of the platform as well as at the mezzanine level. Typically, the platform is approximately 29'-4" wide. Columns are spaced 15' on center, column faces are usually 9'-0" from the edge of the platform. Vertical clearances vary at different parts of the platform. Towards the western-end of the platform, vertical clearance lowers from 8'-2" to 7'-0". There are many conduits over the platform, with less over the platform edge. See figure 1 for the 42nd Street-Times Square station plan and figure 3 for a typical platform edge view at this station.

Full Height PSDs: As indicated in the summary, coordination/relocation of train signal boxes would be required in the implementation of a full height system. Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

*Half Height PSDs (aka APGs)***:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, entrapment prevention sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be CCTV cameras over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Wall-mounted conduit below the platform edges would need to be coordinated to accommodate the requirements of the APG system.

Equipment Room

One room can be accommodated on the lower mezzanine next to the scissor lift storage room. The proposed room dimension is approximately 26'-6" x 7'-0" (see figure 2).

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 2.25. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

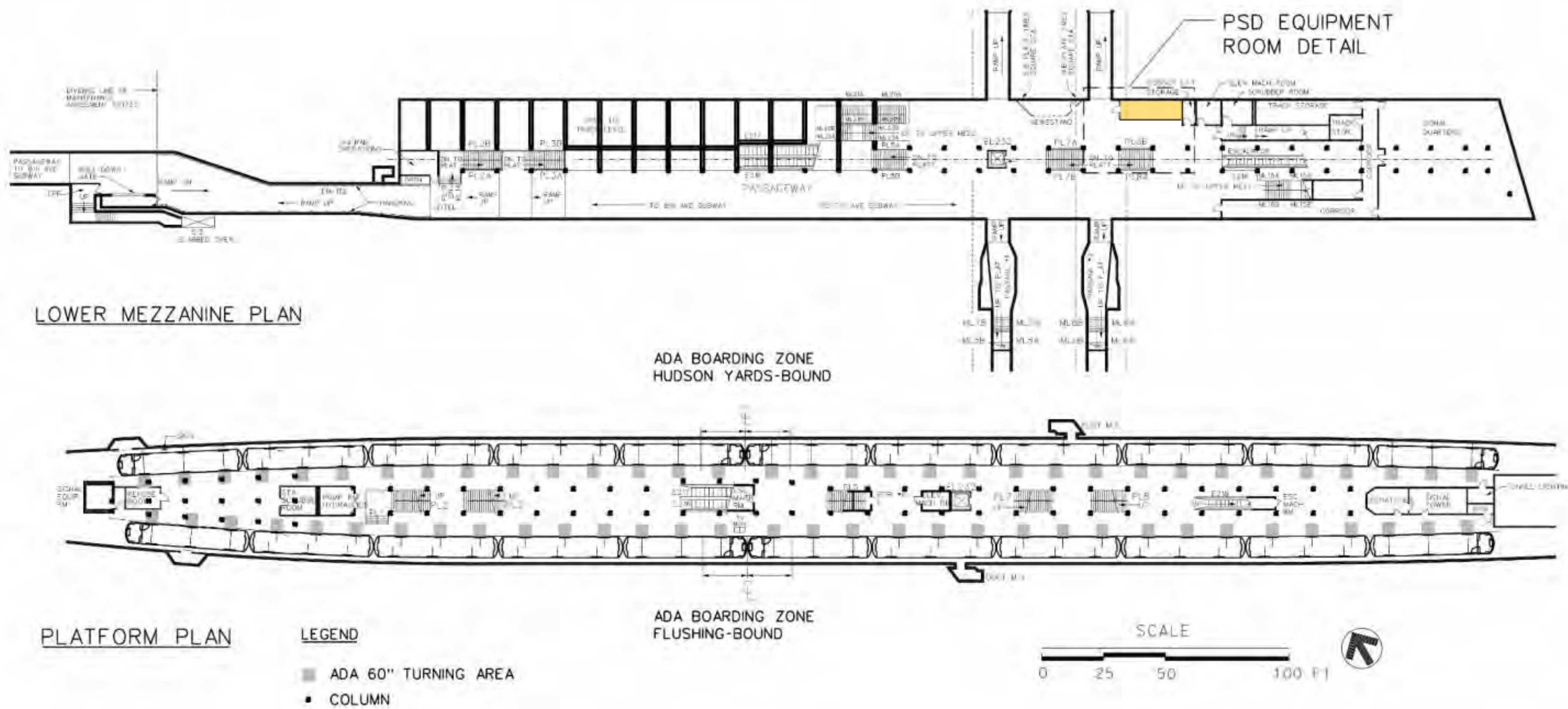

Figure 1 – Station Plan- 42nd Street-Times Square Station

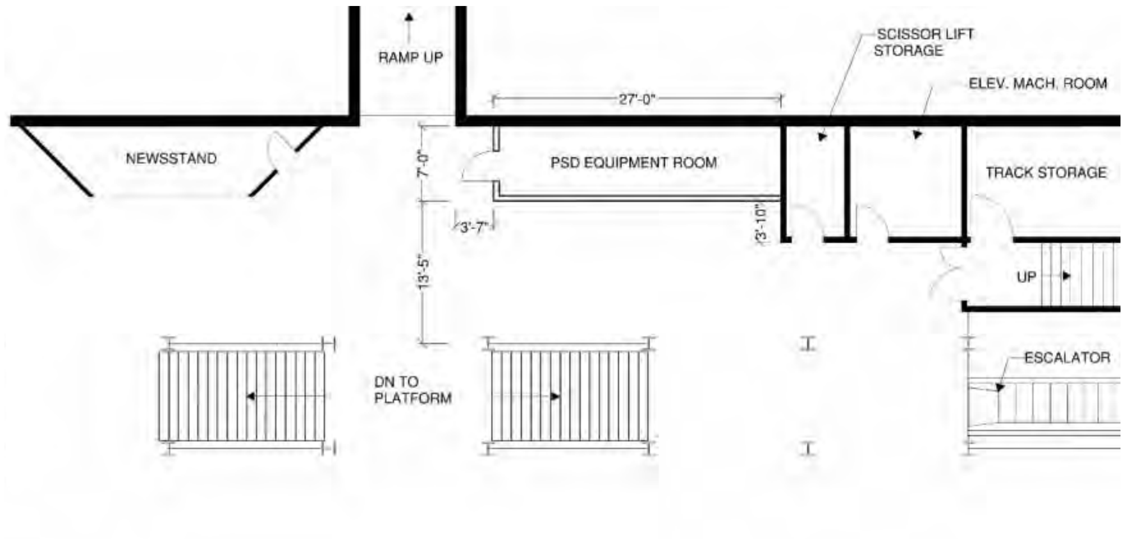

Figure 2 – PSD Equipment Room Detail - 42nd Street-Times Square Station

Platform obstructions within 5' of edge:

Hudson Yard-bound: Five columns on the western side of the station are 30" from the platform edge. Four of these columns are currently in front of train doors, however the implementation of a platform edge barrier would not exacerbate these existing conditions.

Flushing-bound: Five columns on the western side of the station are 30" from the platform edge. Two of these columns are currently in front of train doors, however the implementation of a platform edge barrier would not exacerbate these existing conditions.

The use of 22" emergency egress hinged doors are impeded by approximately 1 existing column (total on both platforms).

Lighting:

Existing lighting: Linear fluorescent; approximately 12" from platform edge with a vertical clearance of 8'-2". Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

Power is adequate. See Electrical table on the following page. Calculation is based on APG loads which are the most demanding.

Flushing Line Electrical Power Capacity Analysis	
NYC T Station MR Number	467
Station Name	42nd St - Times Square
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	94
Apparent Power (kVA)	118
Peak Demand Load, Max Current (A)	328
PSD Total Load for 64 Doors, including All Miscellaneous Loads, (A)	165
Total Load (Station Peak + PSD), (A)	493
Station Service Power Capacity, (A)	2,000
Service Spare Capacity, (A)	1,507
Electrical Service is Adequate or Not	Yes

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.4M to install APGs and $38.8M to install PSDs (See Appendix E).

Figure 3 – Typical platform edge condition- 42nd Street-Times Square Station

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1.22 34th Street-Hudson Yards Station

Summary: 34th Street-Hudson Yards Station (MR-471) is feasible for both APGs and PSDs. As there are no columns along the length of the station, there are no ADA obstructions. While the 34th Street-Hudson Yards station is newly constructed, platform structural work will be required to support the requirements of an APG system (see structural report; Appendix B). Existing power is adequate.

Description

34th Street-Hudson Yards Station is a below-grade station with a straight center/island platform. As the terminating station in Manhattan, the two tracks serve Flushing-bound trains. There are eight stairs at multiple locations along the length of the platform providing access from the mezzanine level. The platform structure is made of cast-in-place concrete. Back-of-house elements are found on both ends of the platform and at the mezzanine level. The mezzanine is sleek, featuring curved walls and ceilings. See figure 1 for the platform plan and possible room locations.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs): This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, entrapment prevention sensors may be ceiling-mounted or on the APG unit itself. In any case, there will be CCTV cameras over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

Two rooms can be symmetrically located beneath the stairs at the west and east-end of the platform. Both rooms will measure approximately 7'-6" x 27'. As both conditions are very similar, see figure 2 for a representation of the location for both equipment rooms. In order to maintain the sleek look on the mezzanine and minimize visual impact on the platform, the equipment rooms can be tucked below stairs at towards the ends of the platform (see figure 3 for an image of this condition).

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

As the construction of this station was completed in 2015, structural work would only be required for the installation of an APG system. As this station was only completed in 2015, the platform edge was not scored in the 2012 NYCT conditions survey.

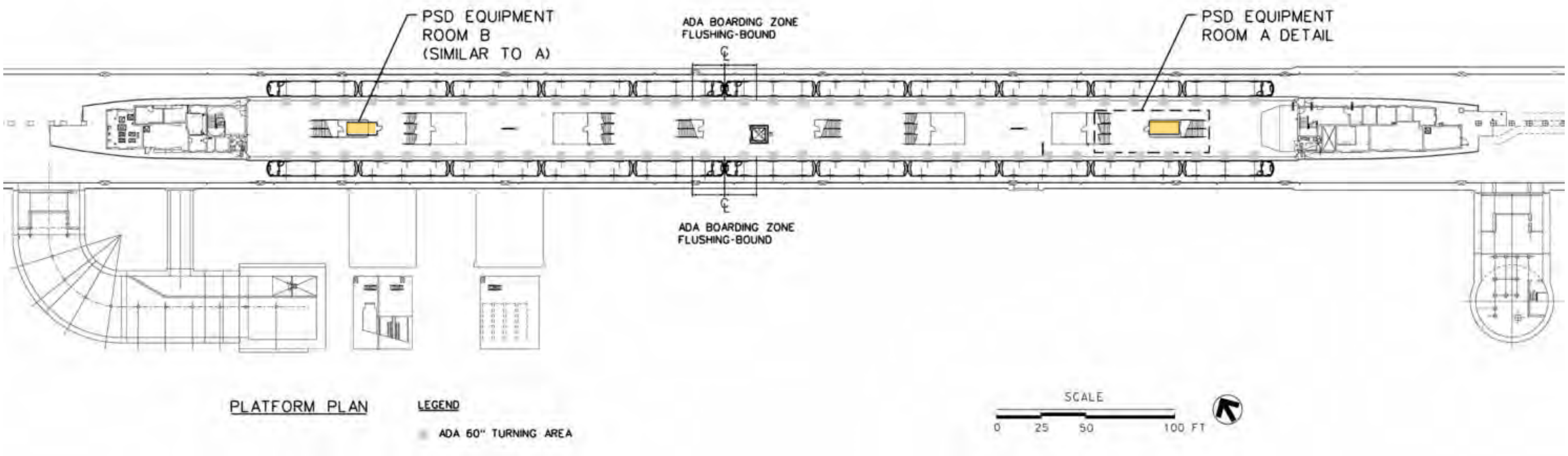

Figure 1 – Station Plan- 34th Street- Hudson Yards Station

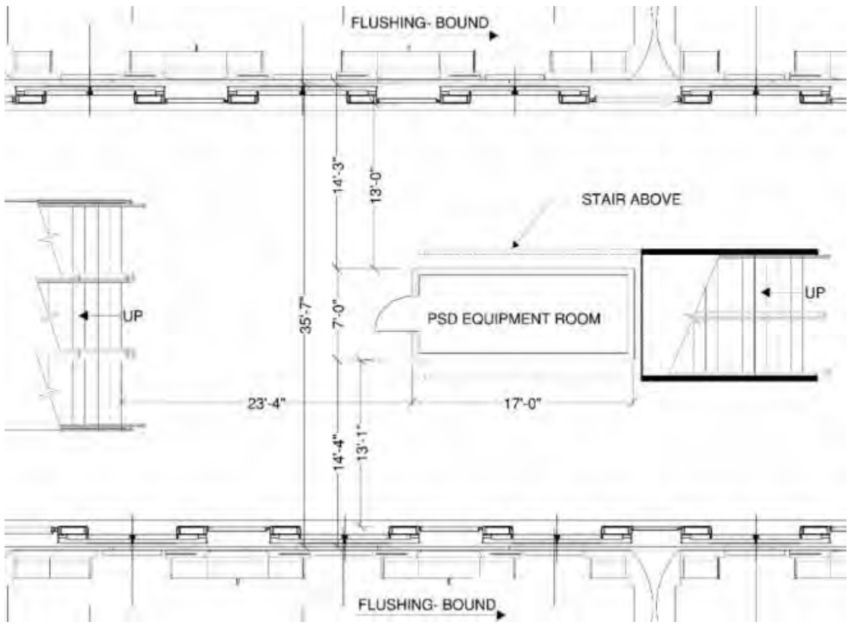

Figure 2 – PSD Equipment Room Detail (similar conditions at both rooms) -34th Street- Hudson Yards Station

Platform obstructions within 5' of edge:

Flushing-bound: No obstructions within 5' of the edge.

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge. Depending on the specific APG / PSD design used, there could be no or minimal alternations to the existing lighting configuration.

Power:

Power is adequate. See Electrical table below. Calculation is based on APG loads which are the most demanding.

Flushing Line Station Electrical Capacity Analysis	
NYC T Station MR Number	471
Station Name	34th Street - Hudson Yards
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	1,993
Apparent Power (kVA)	2,491
Peak Demand Load,Max Current (A)	6,915
PSD Total Load for 64 Doors, including All Miscellaneous Loads, (A)	165
Total Load (Station Peak + PSD), (A)	7,080
Station Service Power Capacity, (A)	15,000
Service Spare Capacity, (A)	7,920
Electrical Service is Adequate or Not	Yes

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Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $33.1M to install APGs and $40.6M to install PSDs (See Appendix E).

Figure 3 –Typical condition beneath stairs-34th Street- Hudson Yards Station

Appendix A: Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*
>
> a. *Column location in relation to the platform edge*
> b. *Platform edge clearance adjacent to stairs and other impediments*
> c. *Impacts to ADA path of travel and boarding areas*
> d. *Conflicts of PSD/APG/RPSDs with Signals cables*
> e. *Sufficient platform width*
> f. *Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*
>
> a. *Structural capacity of platforms to accept PSD/APG/RPSDs*
> b. *Feasibility & location for PSD/APG/RPSDs equipment room*
> c. *Confirmation of adequate power for PSD/APG/RPSDs*
> d. *Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> e. *Determination of communications requirements, availability and cost*
> f. *Determination of gap detection and entrapment avoidance technology requirements*
> g. *Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
    - Double the amount of motors as PSDs (each motor operating a single leaf).
    - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
    - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
    - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY. Status of doors will be provided to crew via indicator lights, with no automated propulsion cutout.

If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

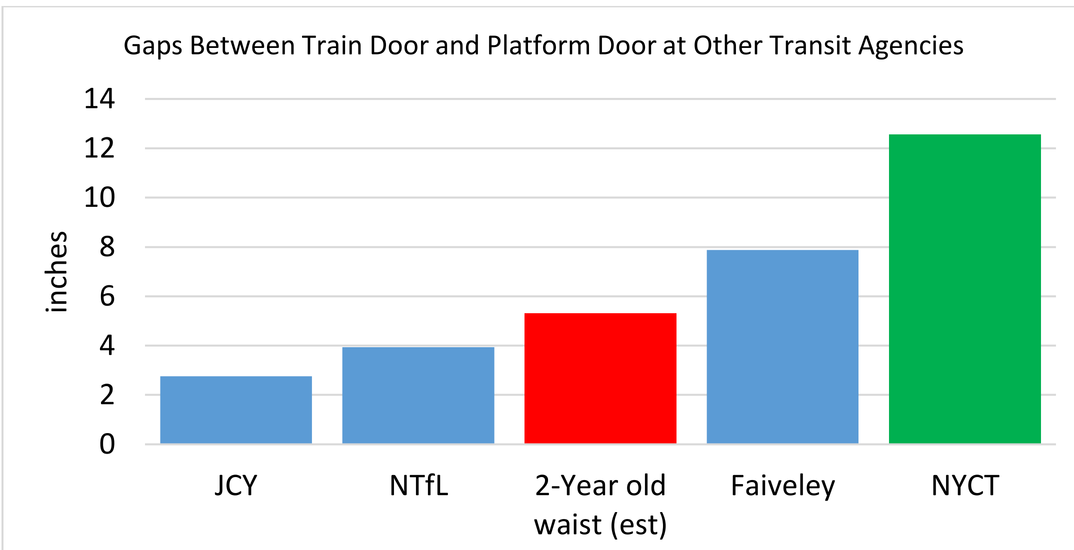


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

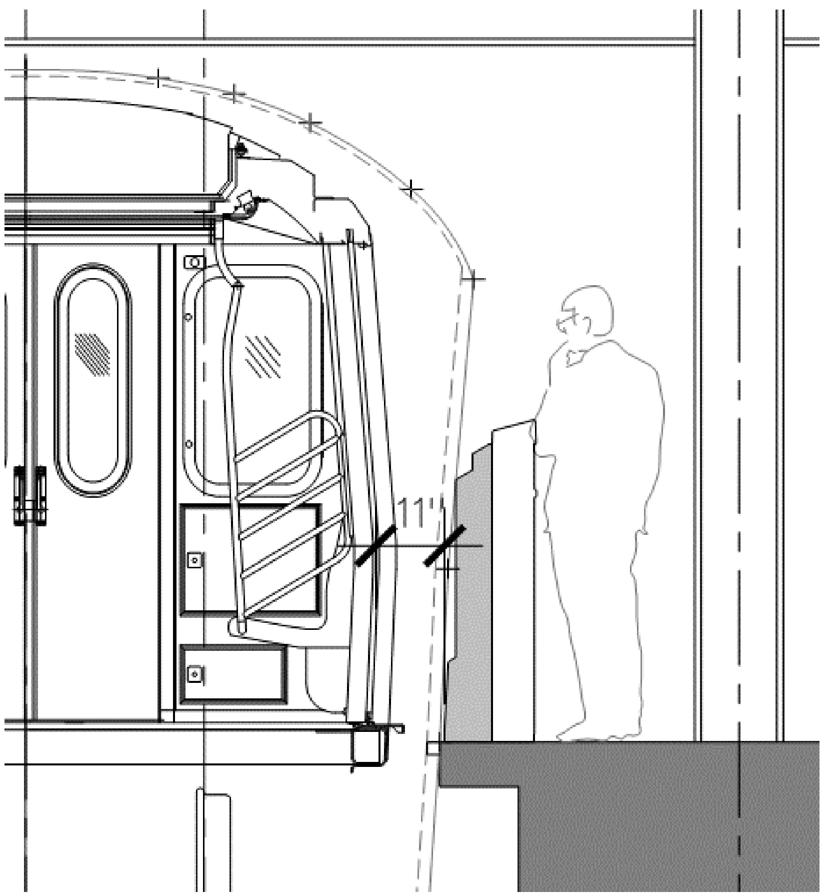


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber “bumpers” on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6” into the line equipment envelope. This would leave a 5” gap between the platform and car doors allowing approximately 2” of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5" by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor's window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor's window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **bold/underline**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	**PSD System 1**	**PSD System 2**	**PSD System 3**
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are "existing" as defined by code. All the rolling stock is also to be considered "existing" under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60" radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36" of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

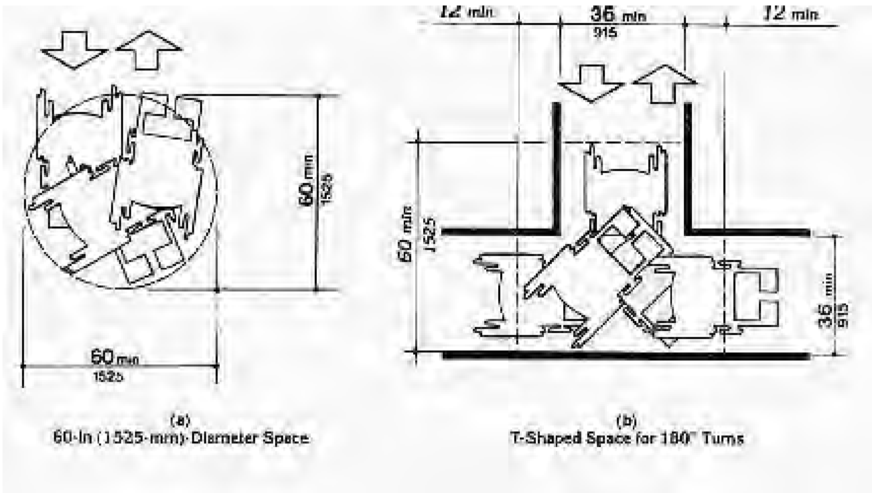
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

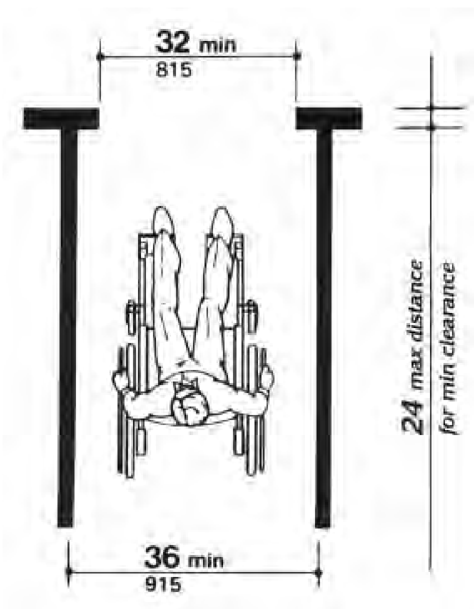


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

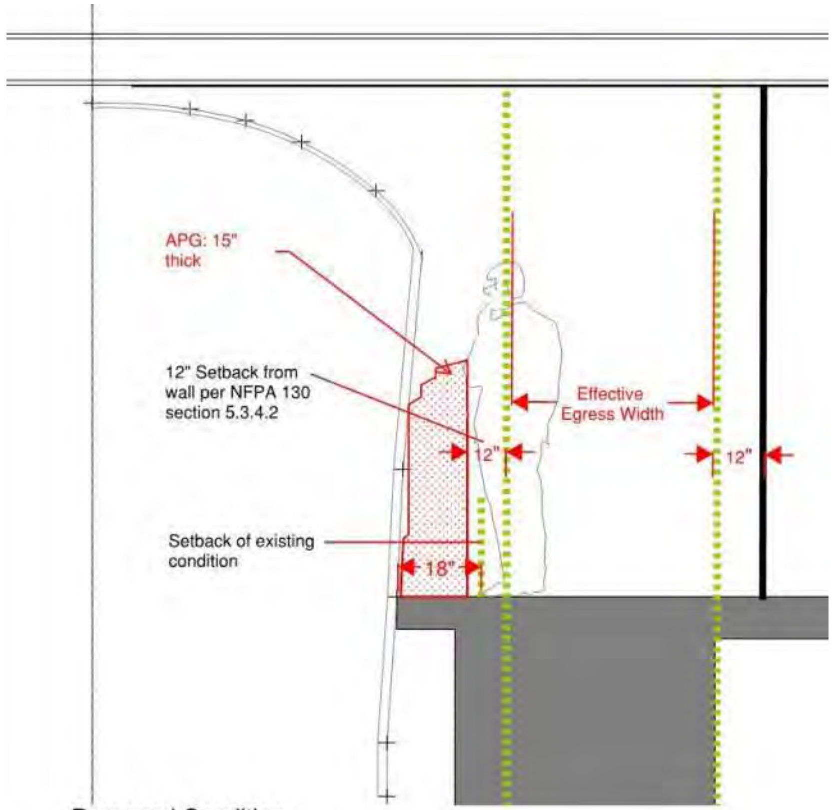
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15" of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

Berthing Report

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

Table of Contents

Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

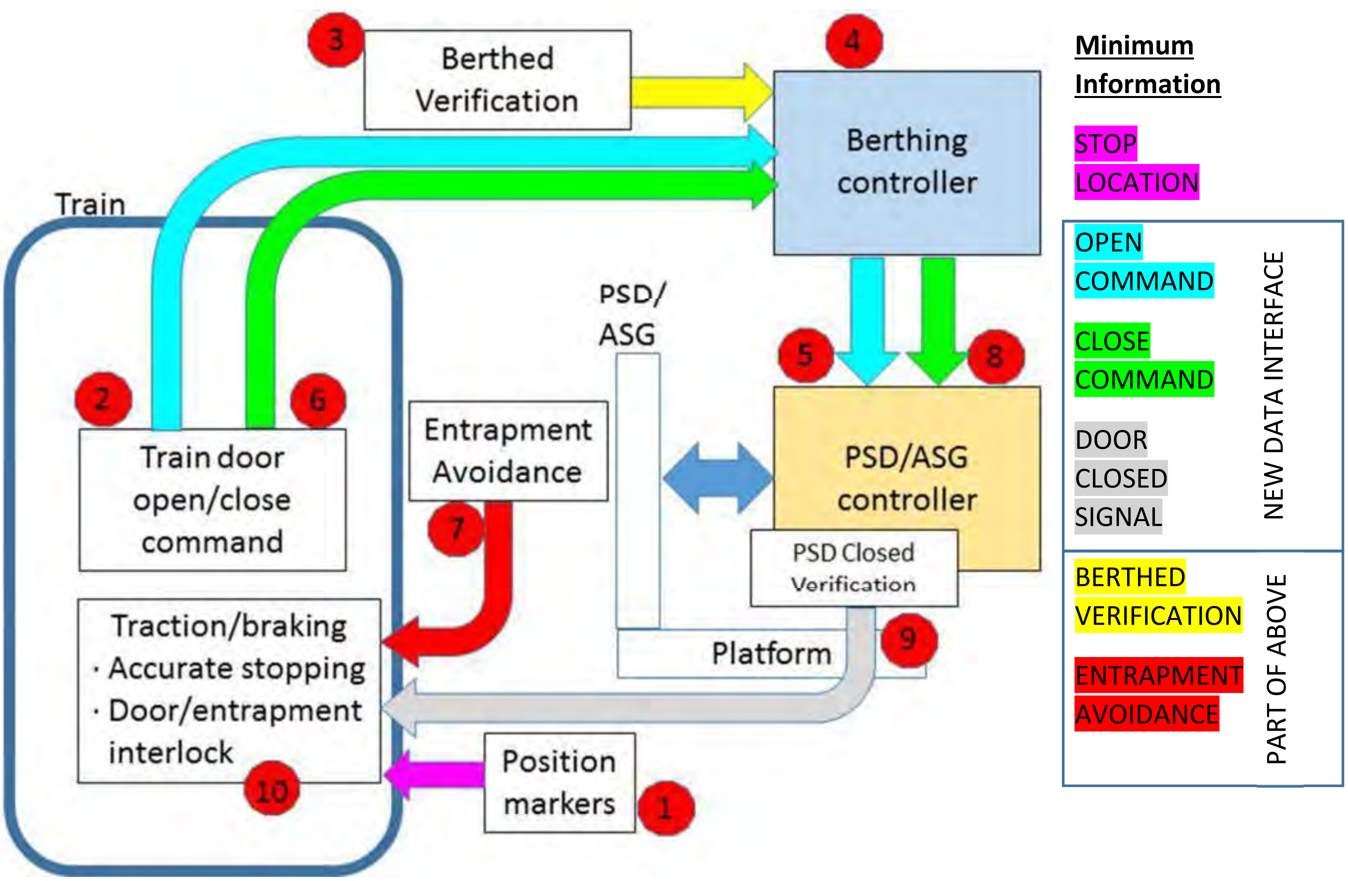
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

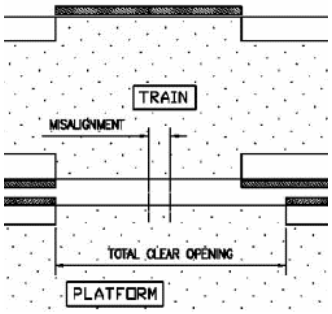
C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5" clear opening, a design for NY should meet the ADA Accessibility Guideline of 36".

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a 'distance totem' which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy's COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

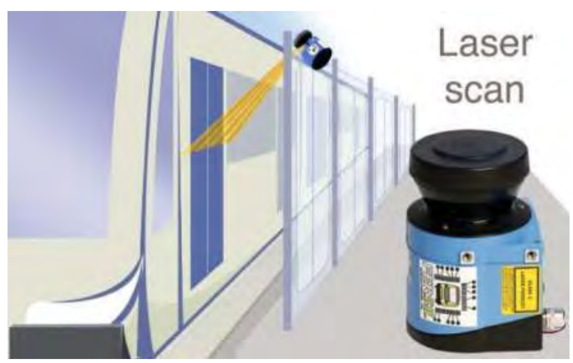
The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically

If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.



For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

End of Appendix

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Appendix B – Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

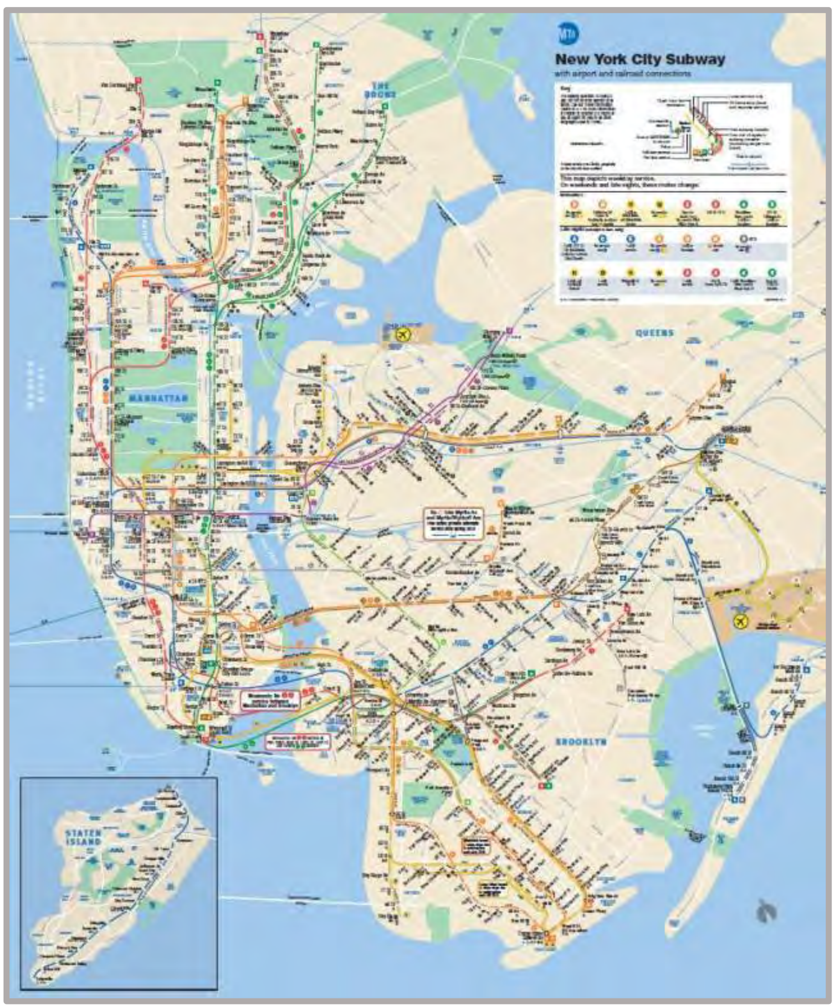

Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4'-0"). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

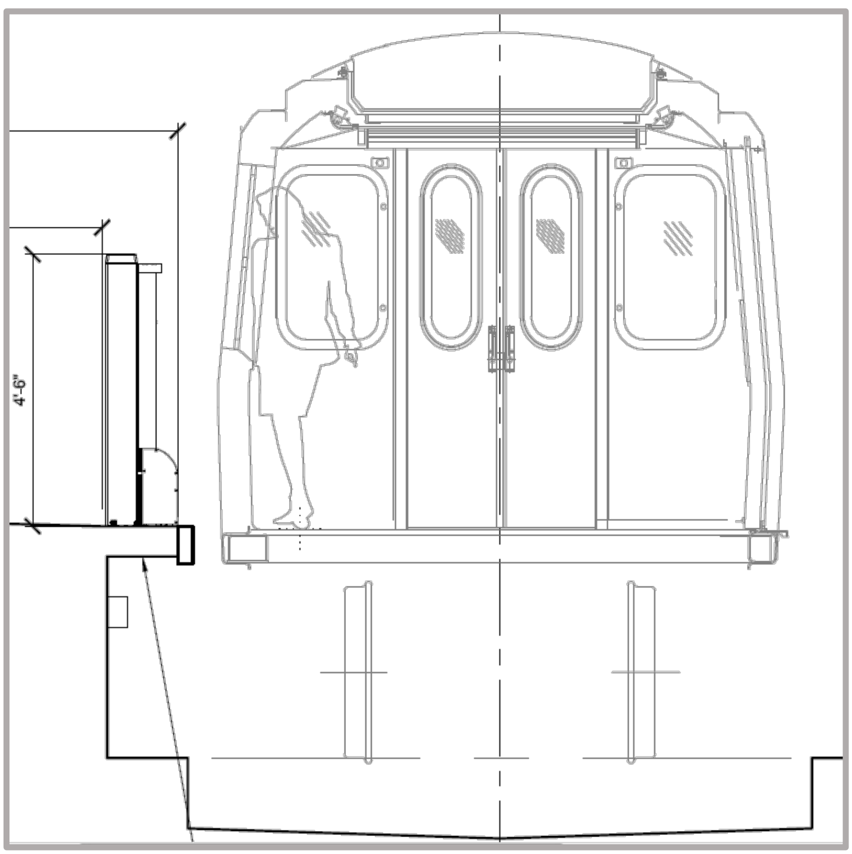

Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 $lbs/ft.^2$ (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

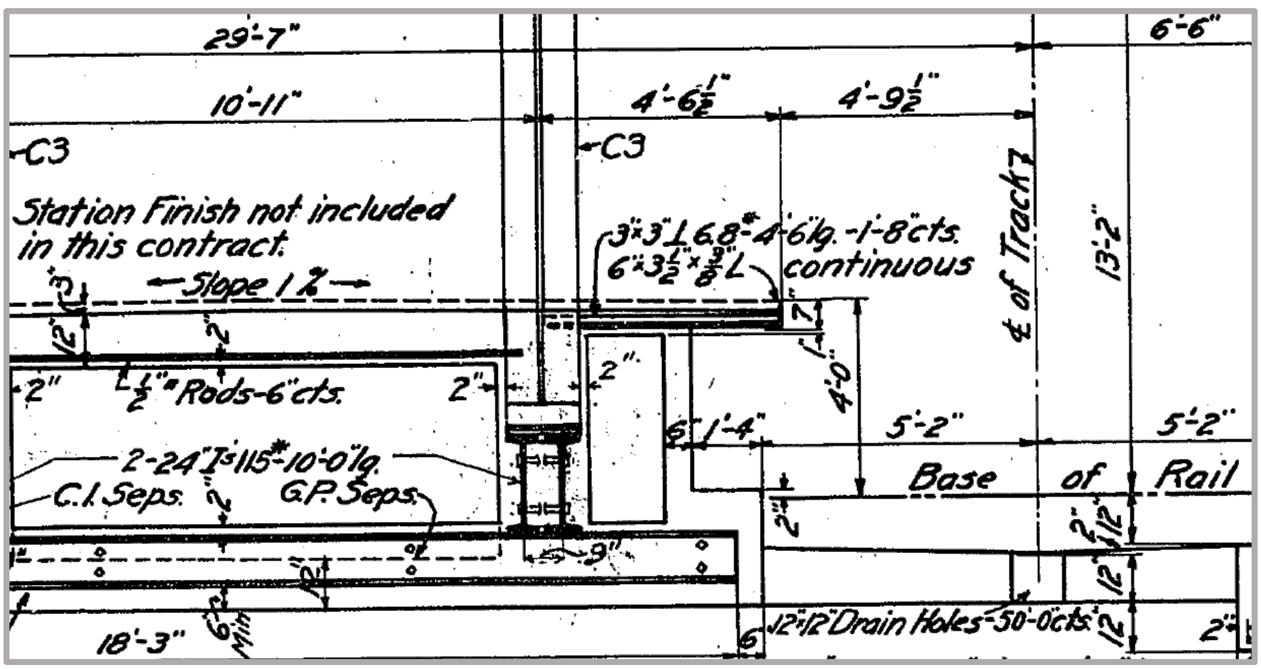

Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

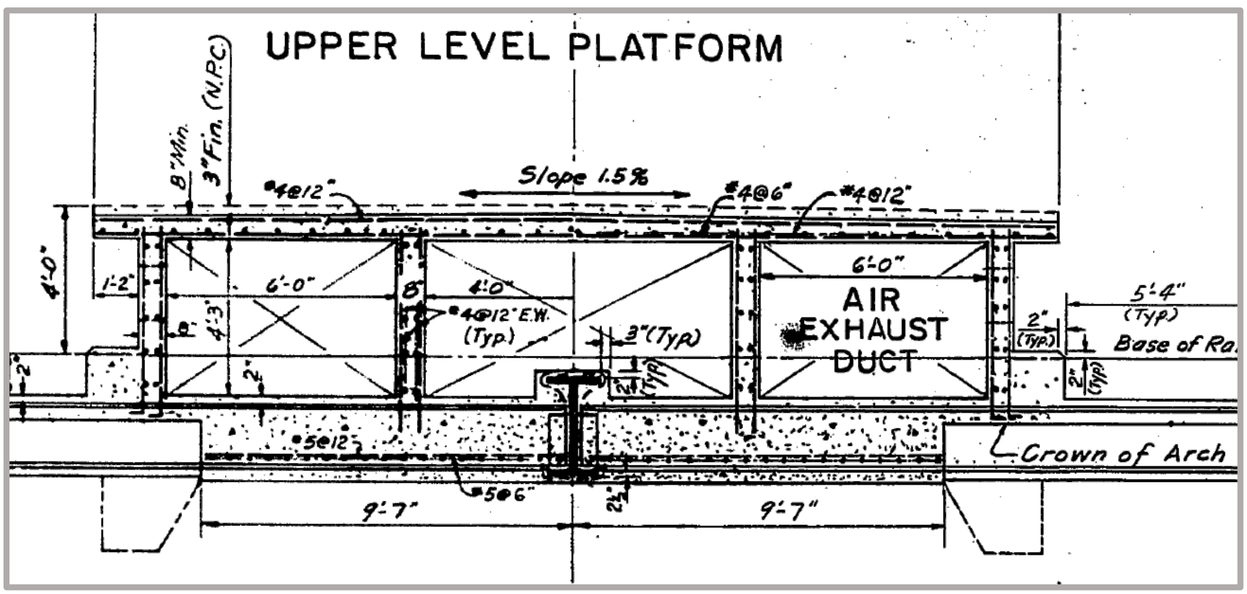

Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

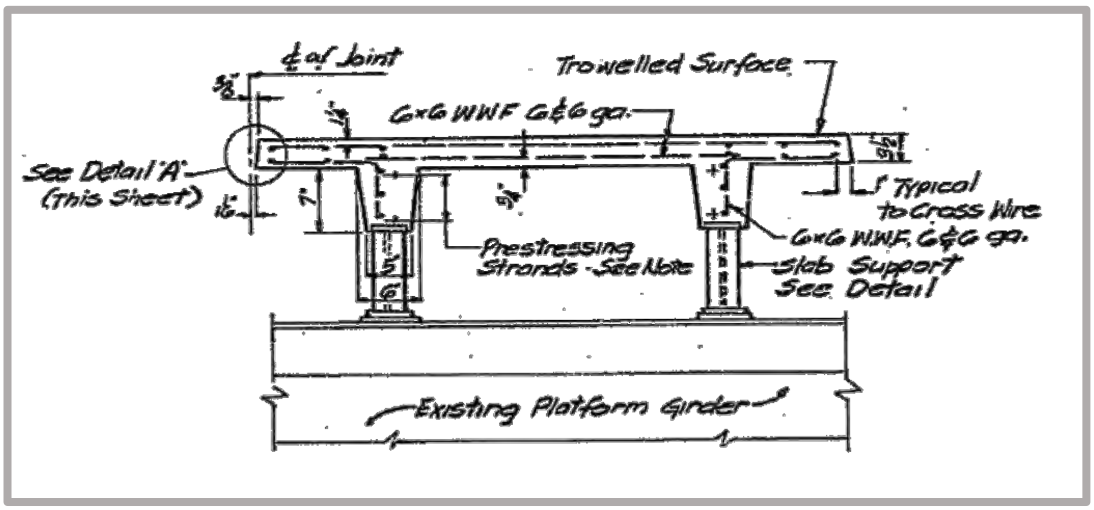

Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

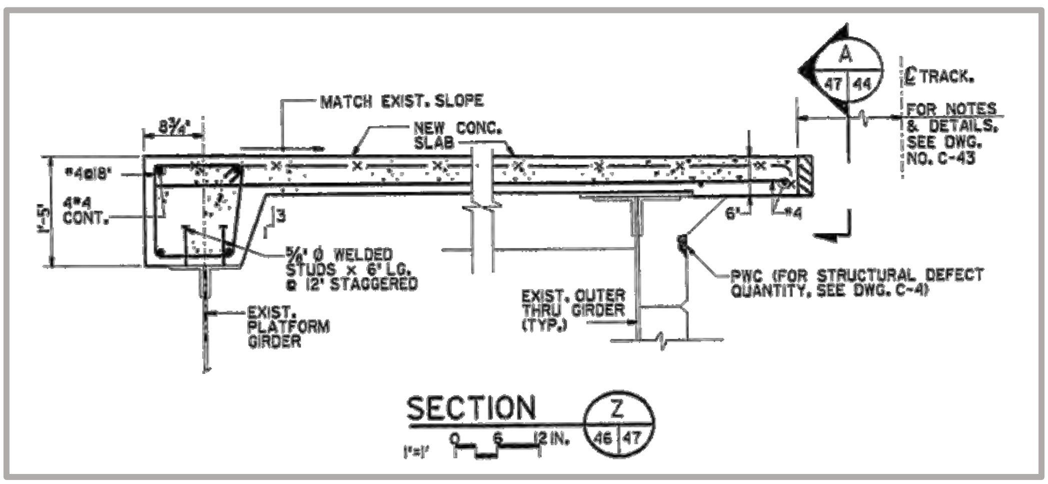

Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2'-9"), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

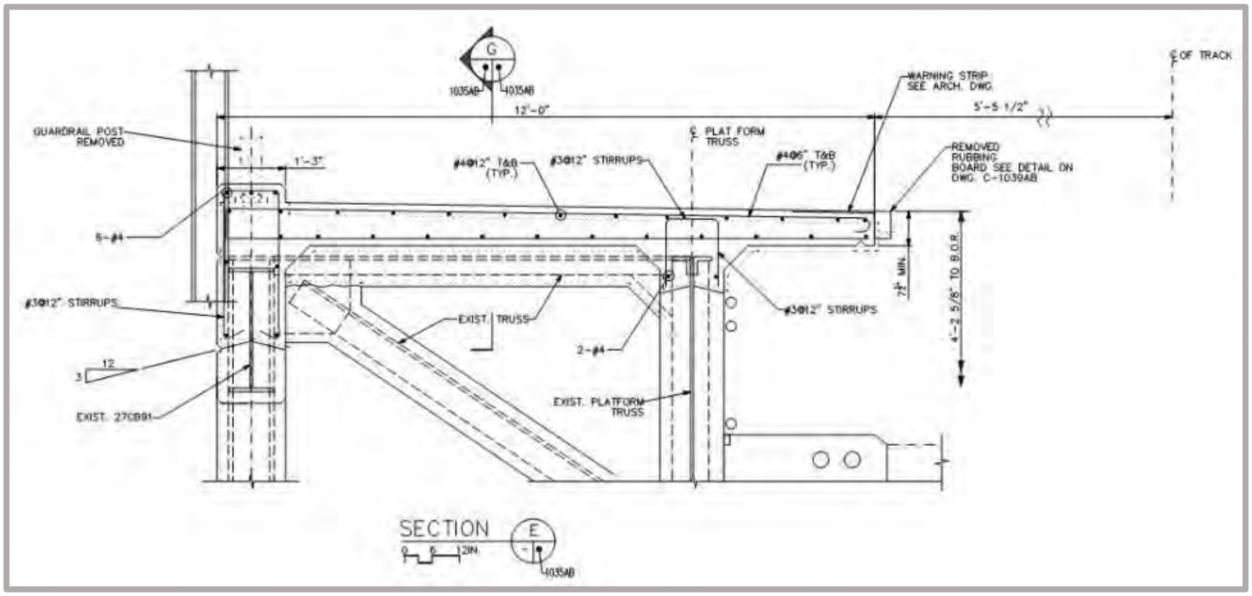

Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3” thick structural slab with an approximately 3” thick topping slab. If the topping slab is fully removed, a 6” thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6” thick slab will be sufficient for a cantilever length of up to approximately 3’-0”, greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6” structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6” minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

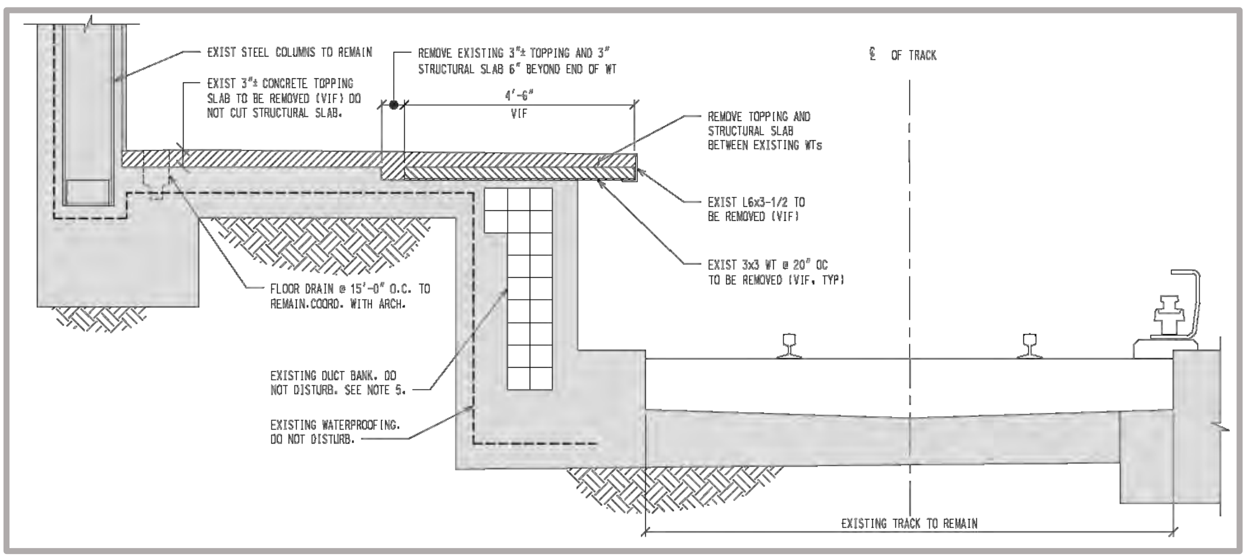

Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

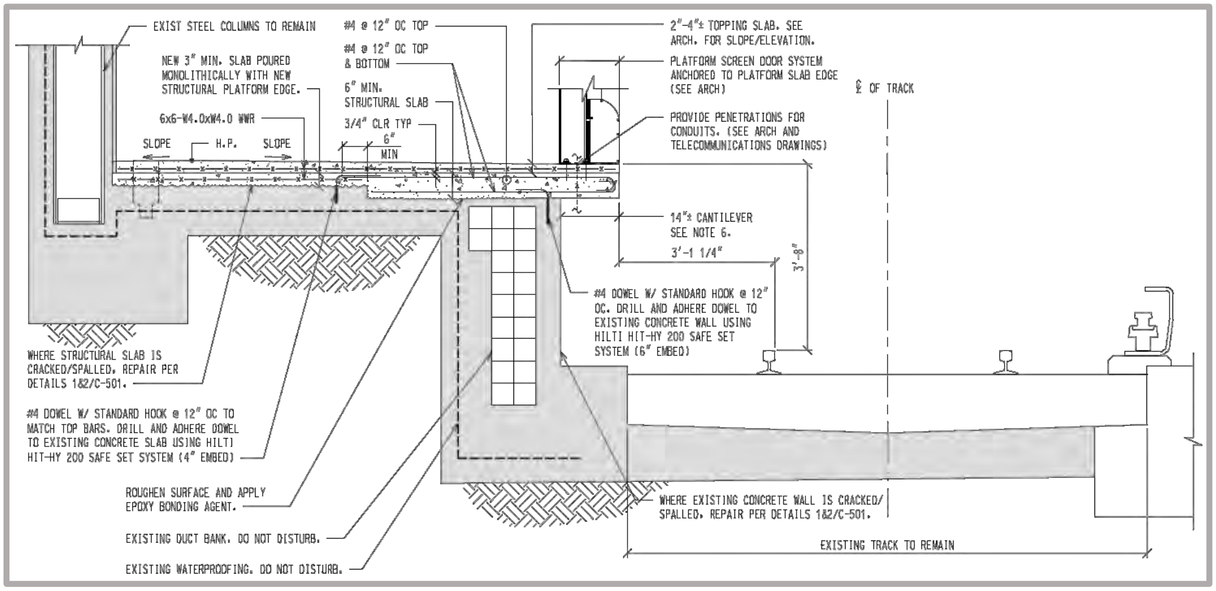

Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

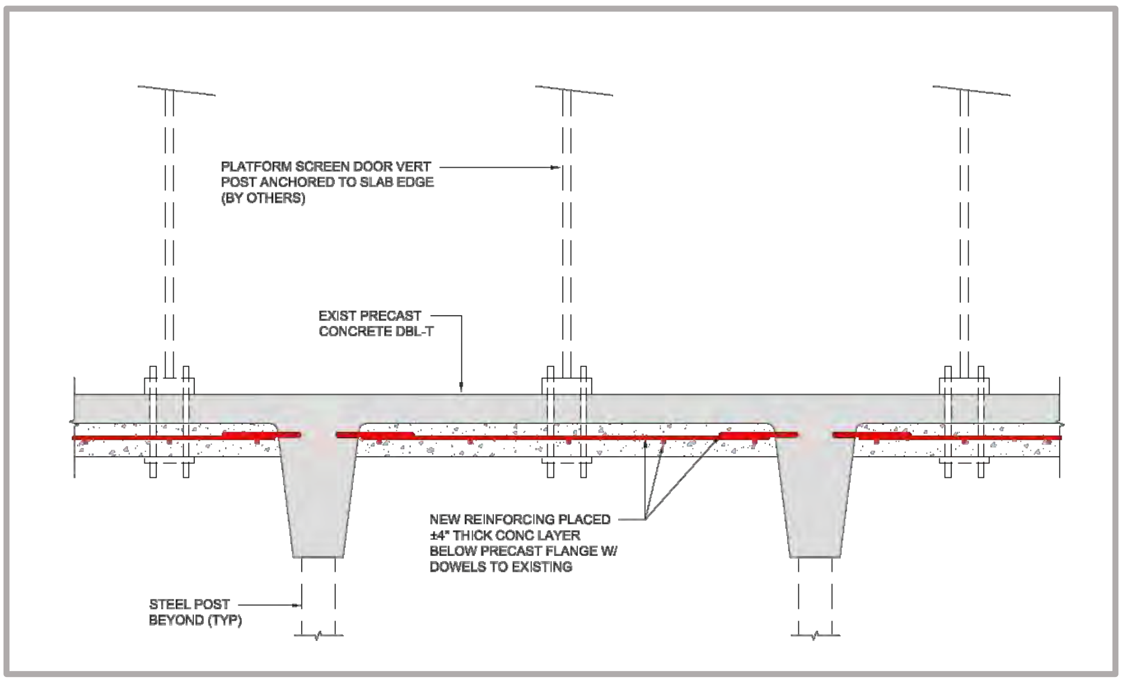

Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C – Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5' – 11" of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

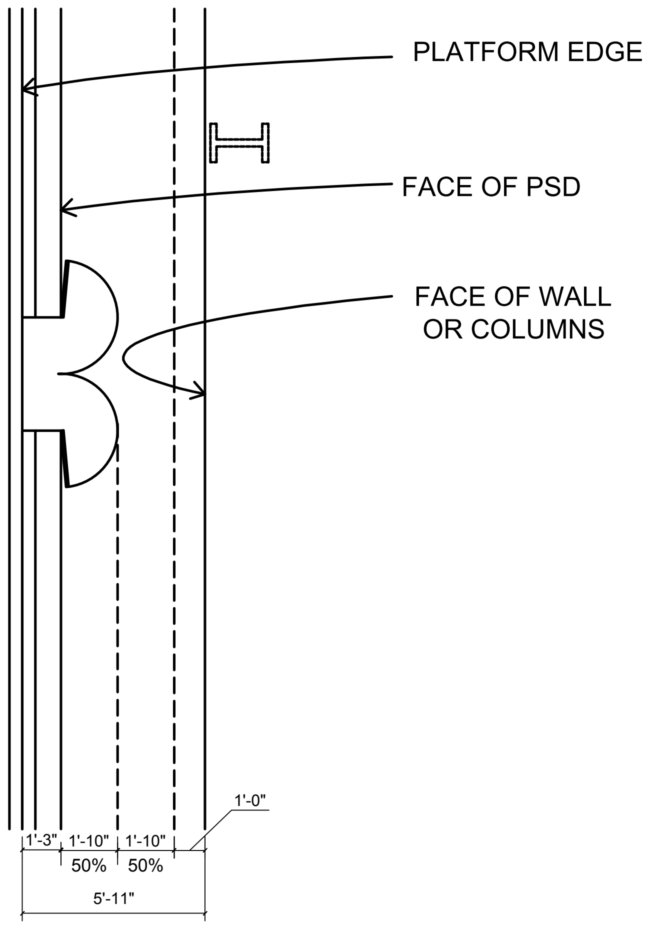

FIGURE 1 – SIDE PLATFORM

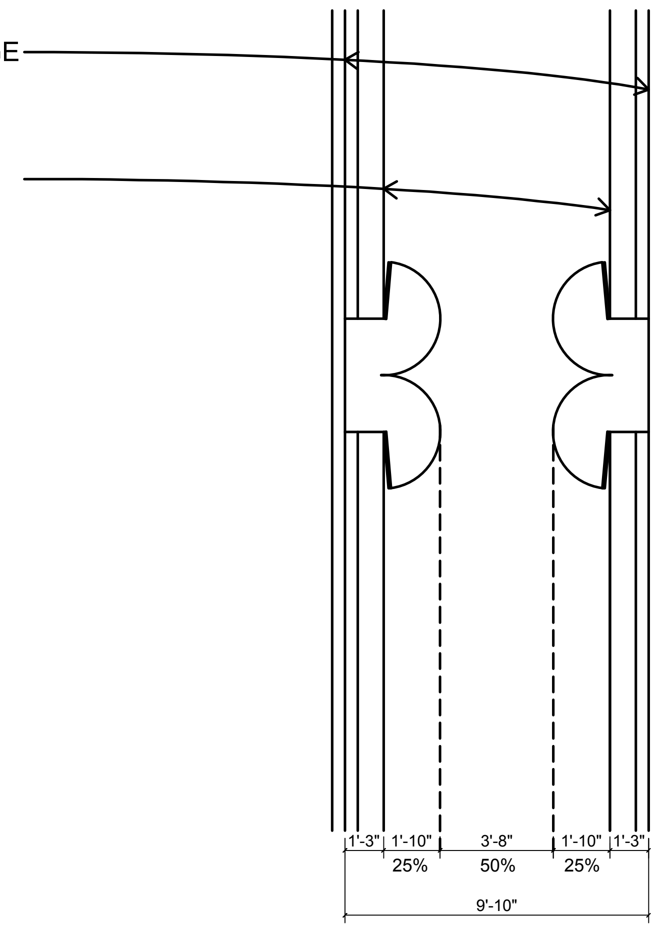

FIGURE 2 – CENTER PLATFORM

Appendix D – Maintenance Cost Estimate

MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the	9	$ 63,500 per month [Year 01]	$ 571,500		
	platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance	12	$ 83,590 per month [Year 02]	$ 1,003,080		
	since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
	remedial repair performed as needed, 24/7, for the	12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
	platform screen door system and ancillary equipment.					
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663		

7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *	
		Year 3	$ 257 per hour *	
	Optional :	Year 4	$ 268 per hour *	
	Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E – Rough Order of Magnitude Costs

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32514
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for IRT Flushing Line Stations in Queens
ESTIMATE DATE:	July 5, 2018

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES

A CONSTRUCTION CONSULTING FIRM

Tier 2-3 Report on Feasibility of Platform Edge Barriers for IRT Flushing Line Stations in Queens

MTA/NYCT

July 5, 2018

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs / PSDs will provide 43 emergency egress doors with push bars per platform*
1.2 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.3 *Each platform edge will have 55 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.2 In respect of the PSD option, only platforms that have not been upgraded in the recent past (assuming over the past two decades) will require platform edge replacement.
2.3 There are no special security requirements made necessary by installation of the APG system
2.4 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.5 This estimate does not provide for the replacement of Platform Edge Lighting
2.6 Premium cost for night time work is considered 50% of total labor cost

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES

A CONSTRUCTION CONSULTING FIRM

Tier 2-3 Report on Feasibility of Platform Edge Barriers for IRT Flushing Line Stations in Queens

MTA/NYCT

July 5, 2018

BASIS OF ESTIMATE

3.0 *Exclusions - Costs not included in the estimate:*

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems

3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length

3.4 Costs associated with NYCT State Of Good Repair improvements to the station

3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.

3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs

3.7 Escalation Cost is not included; Anticipate at 5% per annum.

3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.

3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium

3.10 NYCT project cost is not included

3.11 GO and flagging cost is not included

3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 *Below the line or "soft" costs:*

4.1 Design and Construction Contingency

4.2 Contractor O & P

4.3 Insurance

4.4 NYCT project costs not included

5.0 *Additional Notes*

5.1 *Given the limited time available, no drawings were developed to support this estimate.*

MTA /NYCT

July 5, 2018

Tier 2-3 Report on Feasibility of Platform Edge Barriers for IRT Flushing Line Stations in Queens
IRT Flushing Line Stations

ORDER OF MAGNITUDE COSTS			MR-447	MR-448	MR-461	MR-464	MR-465	MR-467	MR-471
DESCRIPTION			FLUSHING, MAIN STREET	METS-WILLETS POINT	QUEENSBORO PLAZA	VERNON BLVD - JACKSON AVENUE	42ND STREET - GRAND CENTRAL	42ND ST - TIMES SQUARE	34TH ST - HUDSON YARDS
1	AUTOMATIC PLATFORM GATES (APG'S)		$31,780,434	$31,652,552	$17,405,187	$17,433,191	$17,565,743	$16,645,697	$17,566,010
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$31,780,434	$31,652,552	$17,405,187	$17,433,191	$17,565,743	$16,645,697	$17,566,010
4	GENERAL REQUIREMENTS	15.00%	$4,767,065	$4,747,883	$2,610,778	$2,614,979	$2,634,861	$2,496,855	$2,634,901
	SUB-TOTAL:		$36,547,499	$36,400,435	$20,015,965	$20,048,170	$20,200,605	$19,142,551	$20,200,911
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$9,136,875	$9,100,109	$5,003,991	$5,012,043	$5,050,151	$4,785,638	$5,050,228
	SUB-TOTAL:		$45,684,374	$45,500,544	$25,019,956	$25,060,213	$25,250,756	$23,928,189	$25,251,139
6	OVERHEAD & PROFIT	15.00%	$6,852,656	$6,825,082	$3,752,993	$3,759,032	$3,787,613	$3,589,228	$3,787,671
	SUB-TOTAL:		$52,537,030	$52,325,625	$28,772,949	$28,819,245	$29,038,369	$27,517,418	$29,038,810
7	BONDS & INSURANCE	3.75%	$1,970,139	$1,962,211	$1,078,986	$1,080,722	$1,088,939	$1,031,903	$1,088,955
	SUB-TOTAL:		$54,507,169	$54,287,836	$29,851,935	$29,899,966	$30,127,308	$28,549,321	$30,127,765
	SUB-TOTAL:		$54,507,169	$54,287,836	$29,851,935	$29,899,966	$30,127,308	$28,549,321	$30,127,765
	SUBTOTAL CONSTRUCTION COST W/O ACM		**$54,507,169**	**$54,287,836**	**$29,851,935**	**$29,899,966**	**$30,127,308**	**$28,549,321**	**$30,127,765**
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		**$54,507,169**	**$54,287,836**	**$29,851,935**	**$29,899,966**	**$30,127,308**	**$28,549,321**	**$30,127,765**
10	DESIGN CONSULTANT FEES	10.00%	$5,450,717	$5,428,784	$2,985,194	$2,989,997	$3,012,731	$2,854,932	$3,012,777
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST		$59,957,886	$59,716,620	$32,837,129	$32,889,963	$33,140,039	$31,404,253	$33,140,542

	ADD ALTERNATIVES								
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		8,037,035	7,925,787	4,485,167	4,414,533	4,477,592	3,899,079	4,159,045
	Add for Markups (as above)	88.66%	7,125,867	7,027,232	3,976,679	3,914,052	3,969,963	3,457,036	3,687,530
			$15,162,902	$14,953,018	$8,461,846	$8,328,585	$8,447,555	$7,356,114	$7,846,575

5-Jul-18

STATION: FLUSHING-MAIN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] SIDE 01=	628	LF		
5	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] SIDE 02=	594	LF		
6	LENGTH OF THE PLATFORM EDGE [FLUSHING BOUND] SIDE 01=	592	LF		
7	LENGTH OF THE PLATFORM EDGE [FLUSHING BOUND] SIDE 02=	621	LF		
8	TOTAL LENGTH OF THE PLATFORM EDGE =	2,435	LF		
9					
10	AUTOMATIC PLATFORM GATES [APG's]				
11					
12	Platform edge reconstruction				
13	Demolition				
14	Remove existing polyethylene edge strip	2,435	LF	7	17,045
15	Remove 5' wide section of 3" deep structural slab to platform edge	12,175	SF	12	146,100
16	New Work				
17	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	245	CY	2,500	612,500
18	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	2,439	EA	25	60,975
19	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	2,439	EA	25	60,975
20	Cast in assemblies for PSD holding down bolts	1,408	EA	180	253,440
21	Polyethylene edge strip	2,435	LF	95	231,325
22	Provide sleeves for HV & LV wires	720	EA	110	79,200
23					
24	Platform edge finishes				
25	Demolition				
26	Remove existing tactile warning strip 2' wide	2,435	LF	15	36,525
27	Remove existing platform tiles	2,435	LF	12	29,220
28	Sawcut existing topping concrete at perimeter of removal area	2,435	LF	5	12,175
29	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	14,610	SF	8	116,880
30	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 17'-8" wide strip at ADA boarding area	498	SF	8	3,985

STATION: FLUSHING-MAIN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
31	New Work				
32	New concrete topping to match existing	2,435	SF	15	36,525
33	New concrete topping at ADA boarding area to match existing	498	SF	15	7,471
34	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	1,056	LF	110	116,160
35	Misc. patchwork	1	LS	50,000	50,000
36					
37	Equipment Room [14'-0" x 27'-0"]				
38	Build off existing platform slab		Note		
39	Form 8" wide concrete curb including dowelling to platform slab	82	LF	90	7,380
40	CMU Wall for equipment room	820	SF	45	36,900
41	Vertical connections with existing structure	-	LF	25	-
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	820	SF	40	32,800
45	Mosaic Band to match existing - Assuming 8" high	82	LF	120	9,840
46	Concrete cove to match existing	82	LF	20	1,640
47	Interior Wall Finish - Paint	820	SF	5	4,100
48	Allow for Misc. floor & ceiling finishes	378	SF	15	5,670
49	Allow for 4" thick concrete pads for equipment	95	SF	20	1,890
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	Automatic Platform Gates [APGs] - 4'-6" High				
56	Automatic bi-parting gates; Assumed 6'-0" wide (11 Cars x 4 Doors = 44 No. per platform x #2)	176	EA	15,000	2,640,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	172	EA	10,500	1,806,000
58	Double egress/service gate in the center of the platform; #1 per Platform	4	EA	20,000	80,000
59	Platform End Gates (PEGs)	8	EA	13,000	104,000
60	Fixed Panels including framing and support; 4'-6" High	3,740	SF	750	2,804,625
61	Spare Parts - Approx. 10% of Material Cost	1	LS	446,078	446,078
62	Testing and commissioning	1,600	HRS	160	255,888
63	Product Warranty	1	LS	1,500,000	1,500,000
64	Allowance for Braille Signage	176	EA	2,500	440,000
65					
66	Electrical				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				

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STATION: FLUSHING-MAIN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	400,000	400,000
71	Allow for conduit / cable runs for power and communications under platform edge	2,435	LF	60	146,100
72	PSD Connections	1	LS	150,000	150,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	400,000	400,000
74	Power to PSD Room from EDR including track crossing if needed	600	LF	60	36,000
75	Reserve power to PSD Room from EDR including track crossing if needed	600	LF	60	36,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	60,000	60,000
79	MISC				
80	Testing and commissioning	1	LS	60,000	60,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	40,000	40,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	200,000	200,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	220	EA	12,000	2,640,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	200,000	200,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	11	EA	16,000	176,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	11	EA	15,000	165,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	528	EA	4,629	2,444,239
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	528	EA	5,566	2,938,618
96	Engineering and Testing	4,000	Hrs	160	639,720
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000

STATION: FLUSHING-MAIN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	50,000	50,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	80,000	80,000
102	Site Survey and Inspections	1	LS	200,000	200,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	300,000	300,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	100,000	100,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Allow loss of production to work at night say 50%	1	LS	7,333,946	7,333,946
112	TOTAL PSD WORK:				$ 31,780,434
114					
115	ADD ALTERNATIVE				
116					
117	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
118					
119	ADD				
120	Automatic bi-parting doors (11 Cars x 4 Doors = 44 No. per platform)	176	EA	25,000	4,400,000
121	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	172	EA	15,000	2,580,000
122	Double egress/service gate in the center of the platform; #1 per Platform	4	EA	30,000	120,000
123	Platform End Gates (PEGs)	8	EA	18,000	144,000
124	Fixed Panels including framing and support; Assuming 8'-0" high	8,788	SF	750	6,590,802
125	Spare Parts - Approx. 10% of Material Cost	1	LS	830,088	830,088
126	Structual framing / bracing				
127	HSS4x4x1/2 hanger	9	TONS	17,500	160,375
128	L6x6x1/2 continuous angle	18	TONS	17,500	313,628
129	Drilling and bolting - 4 bolts at each connection	974	EA	216	210,384
130	Platform Edge Repair - Not Required				
131	Remove concrete platform edge	-	LF	27	-
132	Platform edge repair	-	LF	109	-
133	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	-	EA	10	-
134					
135	OMIT				
136	Automatic bi-parting gates; Assumed 6'-0" wide (11 Cars x 4 Doors = 44 No. per platform x #2)	(176)	EA	15,000	(2,640,000)

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STATION: FLUSHING-MAIN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
137	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	(172)	EA	10,500	(1,806,000)
138	Double egress/service gate in the center of the platform; #1 per Platform	(4)	EA	20,000	(80,000)
139	Platform End Gates (PEGs)	(8)	EA	13,000	(104,000)
140	Fixed Panels including framing and support; 4'-6" High	(3,740)	SF	750	(2,804,625)
141	Spare Parts - Approx. 10% of Material Cost	(1)	LS	446,078	(446,078)
142	Platform Edge Reconstruction work	(1)	LS	1,133,990	(1,133,990)
143	Remove allowance for cast in sleeves for LV & HV power	(720)	EA	110	(79,200)
144	Conduit running under Platform Edge	(2,435)	LF	30	(73,050)
145					
146	Allow loss of production to work at night say 50%	1	LS	1,854,700	1,854,700
147					
148	PREMIUM ASSOCIATED WITH PSD's				8,037,035

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for IRT Flushing Line Stations in Queens

5-Jul-18

STATION: METS-WILLETS POINT

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [NORTH TRACK] SIDE 01 =	622	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH TRACK] SIDE 02 =	565	LF		
6	LENGTH OF THE PLATFORM EDGE [SOUTH TRACK] SIDE 01 =	569	LF		
7	LENGTH OF THE PLATFORM EDGE [SOUTH TRACK] SIDE 02 =	565	LF		
8	TOTAL LENGTH OF THE PLATFORM EDGE =	2,321	LF		
9					
10	AUTOMATIC PLATFORM GATES [APG's]				
11					
12	Platform edge reconstruction				
13	Demolition				
14	Remove existing polyethylene edge strip	2,321	LF	7	16,247
15	Remove 5' wide section of 3" deep structural slab to platform edge	11,605	SF	12	139,260
16	New Work				
17	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	233	CY	2,500	582,500
18	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	2,325	EA	25	58,125
19	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	2,325	EA	25	58,125
20	Cast in assemblies for PSD holding down bolts	1,408	EA	180	253,440
21	Polyethylene edge strip	2,321	LF	95	220,495
22	Provide sleeves for HV & LV wires	720	EA	110	79,200
23					
24	Platform edge finishes				
25	Demolition				
26	Remove existing tactile warning strip 2' wide	2,321	LF	15	34,815
27	Remove existing platform tiles	2,321	LF	12	27,852
28	Sawcut existing topping concrete at perimeter of removal area	2,321	LF	5	11,605
29	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	13,926	SF	8	111,408
30	Remove existing 3" concrete topping at 44' long ADA boarding area	1,958	SF	8	15,664
31	New Work				
32	New concrete topping to match existing	2,321	SF	15	34,815

5-Jul-18

STATION: METS-WILLETS POINT

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
33	New concrete topping at ADA boarding area to match existing	1,958	SF	15	29,370
34	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	1,056	LF	110	116,160
35	Misc. patchwork	1	LS	50,000	50,000
36					
37	Equipment Room				
38	North Track [7'-0" x 27'-0"]				
39	Build off existing elevated platform slab		Note		
40	Form 8" wide concrete curb including dowelling to platform slab	68	LF	90	6,120
41	CMU Wall for equipment room	680	SF	45	30,600
42	Roof				
43	Structural Steel Roof Framing; say 15 lbs / sf	2	TONS	17,500	35,000
44	New standing seam roof sheeting	189	SF	38	7,182
45	Roof gutters and down spout	27	LF	40	1,080
46	Powder Coated Aluminum Parapet Flashing	68	LF	45	3,060
47	Fire rated door including frame & hardware	1	EA	2,500	2,500
48	Exterior wall finish				
49	Metal cladding to exterior	680	SF	50	34,000
50	Interior Wall Finish - Paint	680	SF	5	3,400
51	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
52	Allow for 4" thick concrete pads for equipment	47	SF	20	945
53	Allowance for Mechanical Scope	1	LS	40,000	40,000
54	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
55	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
56	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
57	SouthTrack [7'-0" x 27'-0"]				
58	Build off existing elevated platform slab		Note		
59	Form 8" wide concrete curb including dowelling to platform slab	68	LF	90	6,120
60	CMU Wall for equipment room	680	SF	45	30,600
61	Roof				
62	Structural Steel Roof Framing; say 15 lbs / sf	2	TONS	17,500	35,000
63	New standing seam roof sheeting	189	SF	38	7,182
64	Roof gutters and down spout	27	LF	40	1,080
65	Powder Coated Aluminum Parapet Flashing	68	LF	45	3,060
66	Fire rated door including frame & hardware	1	EA	2,500	2,500
67	Exterior wall finish				
68	Metal cladding to exterior	680	SF	50	34,000
69	Interior Wall Finish - Paint	680	SF	5	3,400
70	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
71	Allow for 4" thick concrete pads for equipment	47	SF	20	945
72	Allowance for Mechanical Scope	1	LS	40,000	40,000
73	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000

STATION: METS-WILLETS POINT

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
74	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
75	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
76					
77	Automatic Platform Gates [APGs] - 4'-6" High				
78	Automatic bi-parting gates; Assumed 6'-0" wide (11 Cars x 4 Doors = 44 No. per platform x #2)	176	EA	15,000	2,640,000
79	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	172	EA	10,500	1,806,000
80	Double egress/service gate in the center of the platform; #1 per Platform	4	EA	20,000	80,000
81	Platform End Gates (PEGs)	8	EA	13,000	104,000
82	Fixed Panels including framing and support; 4'-6" High	3,227	SF	750	2,419,875
83	Spare Parts - Approx. 10% of Material Cost	1	LS	422,993	422,993
84	Testing and commissioning	1,600	HRS	160	255,888
85	Product Warranty	1	LS	1,500,000	1,500,000
86	Allowance for Braille Signage	176	EA	2,500	440,000
87					
88	Electrical				
89	Electrical Upgrades				
90	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
91	Power and Lighting				
92	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	400,000	400,000
93	Allow for conduit / cable runs for power and communications under platform edge	2,321	LF	60	139,260
94	PSD Connections	1	LS	150,000	150,000
95	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	400,000	400,000
96	Power to PSD Room from EDR including track crossing if needed	300	LF	60	18,000
97	Reserve power to PSD Room from EDR including track crossing if needed	600	LF	60	36,000
98	No allowance for new lighting as if APG's are used		Note		EXCL.
99	Grounding				
100	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	60,000	60,000
101	MISC				
102	Testing and commissioning	1	LS	60,000	60,000
103	As Built, Shop Drwgs, Permits and approvals	1	LS	40,000	40,000
104					
105	Communications				
106	FA System				
107	Scope in connection with Fire Alarm System	1	LS	200,000	200,000
108	CCTV coverage				

STATION: METS-WILLETS POINT

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
109	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	220	EA	12,000	2,640,000
110	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	200,000	200,000
111	Berthing Technology Sensors				
112	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	11	EA	16,000	176,000
113	Train Door Detection System				
114	Train Door Detection Sensor including software and hardware requirements	11	EA	15,000	165,000
115	Entrapment concerns				
116	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	528	EA	4,629	2,444,239
117	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	528	EA	5,566	2,938,618
118	Engineering and Testing	4,000	Hrs	160	639,720
119	Centralized monitoring/control				
120	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
121	MISC				
122	Penetration, patching, selective demo and minor modifications	1	LS	50,000	50,000
123	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	80,000	80,000
124	Site Survey and Inspections	1	LS	200,000	200,000
125	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	300,000	300,000
126	Furnish Test Equipment allowance	1	LS	500,000	500,000
127	As Built, Shop Drwgs, Permits and approvals	1	LS	100,000	100,000
128					
129	Training				
130	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
131					
132	Allow loss of production to work at night say 50%	1	LS	7,304,435	7,304,435
133					
134	TOTAL PSD WORK:				$ 31,652,552
135					
136					
137	ADD ALTERNATIVE				
138					
139	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				

5-Jul-18

STATION: METS-WILLETS POINT

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
140					
141	ADD				
142	Automatic bi-parting doors (11 Cars x 4 Doors = 44 No. per platform)	176	EA	25,000	4,400,000
143	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	172	EA	15,000	2,580,000
144	Double egress/service gate in the center of the platform; #1 per Platform	4	EA	30,000	120,000
145	Platform End Gates (PEGs)	8	EA	18,000	144,000
146	Fixed Panels including framing and support; Assuming 8'-0" high	7,876	SF	750	5,906,802
147	Spare Parts - Approx. 10% of Material Cost	1	LS	789,048	789,048
148	Structual framing / bracing				
149	HSS4x4x1/2 hanger	9	TONS	17,500	152,928
150	L6x6x1/2 continuous angle	17	TONS	17,500	298,945
151	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
152	Platform Edge Repair				
153	Remove concrete platform edge	2,321	LF	27	62,667
154	Platform edge repair	2,321	LF	109	252,989
155	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	1,440	EA	10	14,400
156					
157	OMIT				
158	Automatic bi-parting gates; Assumed 6'-0" wide (11 Cars x 4 Doors = 44 No. per platform x #2)	(176)	EA	15,000	(2,640,000)
159	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	(172)	EA	10,500	(1,806,000)
160	Double egress/service gate in the center of the platform; #1 per Platform	(4)	EA	20,000	(80,000)
161	Platform End Gates (PEGs)	(8)	EA	13,000	(104,000)
162	Fixed Panels including framing and support; 4'-6" High	(3,227)	SF	750	(2,419,875)
163	Spare Parts - Approx. 10% of Material Cost	(1)	LS	422,993	(422,993)
164	Platform Edge Reconstruction work	(1)	LS	1,091,450	(1,091,450)
165	Remove allowance for cast in sleeves for LV & HV power	(720)	EA	110	(79,200)
166	Conduit running under Platform Edge	(2,321)	LF	30	(69,630)
167					
168	Allow loss of production to work at night say 50%	1	LS	1,829,028	1,829,028
169					
170	PREMIUM ASSOCIATED WITH PSD's				7,925,787

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for IRT Flushing Line Stations in Queens

5-Jul-18

STATION: QUEENSBORO PLAZA

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	654	LF		
5	LENGTH OF THE PLATFORM EDGE [FLUSHING BOUND] =	588	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,242	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,242	LF	7	8,694
13	Remove 5' wide section of 3" deep structural slab to platform edge	6,210	SF	12	74,520
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	125	CY	3	375
16	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,244	EA	25	31,100
17	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,244	EA	25	31,100
18	Cast in assemblies for PSD holding down bolts	704	EA	180	126,720
19	Polyethylene edge strip	1,242	LF	95	117,990
20	Provide sleeves for HV & LV wires	360	EA	110	39,600
21					
22	Platform edge finishes				
23	Demolition				
24	Remove existing tactile warning strip 2' wide	1,242	LF	15	18,630
25	Remove existing platform tiles	1,242	LF	12	14,904
26	Sawcut existing topping concrete at perimeter of removal area	1,242	LF	5	6,210
27	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,452	SF	8	59,616
28	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 16' wide strip	880	SF	8	7,040
29	New Work				
30	New concrete topping to match existing	1,242	SF	15	18,630
31	New concrete topping at ADA boarding area to match existing	880	SF	15	13,200

STATION: QUEENSBORO PLAZA

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	528	LF	110	58,080
33	Misc. patchwork	1	LS	50,000	50,000
34					
35	**Equipment Room**				
36	**Queens Bound Platform [7'-0" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	68	LF	90	6,120
39	CMU Wall for equipment room	680	SF	45	30,600
40	Roof				
41	Structural Steel Roof Framing; say 15 lbs / sf	2	TONS	17,500	35,000
42	New standing seam roof sheeting	189	SF	38	7,182
43	Roof gutters and down spout	27	LF	40	1,080
44	Powder Coated Aluminum Parapet Flashing	68	LF	45	3,060
45	Fire rated door including frame & hardware	1	EA	2,500	2,500
46	Exterior wall finish				
47	Metal cladding to exterior	680	SF	50	34,000
48	Interior Wall Finish - Paint	680	SF	5	3,400
49	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
50	Allow for 4" thick concrete pads for equipment	47	SF	20	945
51	Allowance for Mechanical Scope	1	LS	40,000	40,000
52	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
53	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
54	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	**Manhattan Bound Platform [7'-0" x 27'-0"]**				
56	Build off existing platform slab		Note		
57	Form 8" wide concrete curb including dowelling to platform slab	68	LF	90	6,120
58	CMU Wall for equipment room	680	SF	45	30,600
59	Roof				
60	Structural Steel Roof Framing; say 15 lbs / sf	2	TONS	17,500	35,000
61	New standing seam roof sheeting	189	SF	38	7,182
62	Roof gutters and down spout	27	LF	40	1,080
63	Powder Coated Aluminum Parapet Flashing	68	LF	45	3,060
64	Fire rated door including frame & hardware	1	EA	2,500	2,500
65	Exterior wall finish				
66	Metal cladding to exterior	680	SF	50	34,000
67	Interior Wall Finish - Paint	680	SF	5	3,400
68	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
69	Allow for 4" thick concrete pads for equipment	47	SF	20	945
70	Allowance for Mechanical Scope	1	LS	40,000	40,000
71	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
72	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000

STATION: QUEENSBORO PLAZA

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
73	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
74					
75	Automatic Platform Gates [APGs] - 4'-6" High				
76	Automatic bi-parting gates; Assumed 6'-0" wide (11 Cars x 4 Doors = 44 No. per platform)	88	EA	15,000	1,320,000
77	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	86	EA	10,500	903,000
78	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
79	Platform End Gates (PEGs)	4	EA	13,000	52,000
80	Fixed Panels including framing and support; 4'-6" High	1,980	SF	750	1,485,000
81	Spare Parts - Approx. 10% of Material Cost	1	LS	228,000	228,000
82	Testing and commissioning	800	HRS	160	127,944
83	Product Warranty	1	LS	1,000,000	1,000,000
84	Allowance for Braille Signage	88	EA	2,500	220,000
85					
86	Electrical				
87	Electrical Upgrades				
88	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
89	Power and Lighting				
90	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
91	Allow for conduit / cable runs for power and communications under platform edge	1,242	LF	60	74,520
92	PSD Connections	1	LS	75,000	75,000
93	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
94	Power to PSD Room from EDR including track crossing if needed	500	LF	60	30,000
95	Reserve power to PSD Room from EDR including track crossing if needed	600	LF	60	36,000
96	No allowance for new lighting as if APG's are used		Note		EXCL.
97	Grounding				
98	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
99	MISC				
100	Testing and commissioning	1	LS	30,000	30,000
101	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
102					
103	Communications				
104	FA System				
105	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
106	CCTV coverage				
107	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	110	EA	12,000	1,320,000

STATION: QUEENSBORO PLAZA

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
108	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
109	Berthing Technology Sensors				
110	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	11	EA	16,000	176,000
111	Train Door Detection System				
112	Train Door Detection Sensor including software and hardware requirements	11	EA	15,000	165,000
113	Entrapment concerns				
114	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	264	EA	4,629	1,222,119
115	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	264	EA	5,566	1,469,309
116	Engineering and Testing	2,000	Hrs	160	319,860
117	Centralized monitoring/control				
118	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
119	MISC				
120	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
121	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
122	Site Survey and Inspections	1	LS	100,000	100,000
123	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
124	Furnish Test Equipment allowance	1	LS	500,000	500,000
125	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
126					
127	Out of hours Work				
128	No allowance included for work outside normal working hours		Note		EXCL.
129					
130	Training				
131	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
132					
133	Allow loss of production to work at night say 50%	1	LS	4,016,582	4,016,582
134					
135	TOTAL PSD WORK:				$ 17,405,187

137					
138	ADD ALTERNATIVE				
139					
140	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
141					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for IRT Flushing Line Stations in Queens

5-Jul-18

STATION: QUEENSBORO PLAZA

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	ADD				
143	Automatic bi-parting doors (11 Cars x 4 Doors = 44 No. per platform)	88	EA	25,000	2,200,000
144	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	86	EA	15,000	1,290,000
145	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
146	Platform End Gates (PEGs)	4	EA	18,000	72,000
147	Fixed Panels including framing and support; Assuming 8'-0" high	4,590	SF	750	3,442,401
148	Spare Parts - Approx. 10% of Material Cost	1	LS	423,864	423,864
149	Structual framing / bracing				
150	HSS4x4x1/2 hanger	5	TONS	17,500	82,441
151	L6x6x1/2 continuous angle	9	TONS	17,500	159,970
152	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
	Platform Edge Repair - **Not Required**				
154	Remove concrete platform edge	-	LF	27	-
155	Platform edge repair	-	LF	109	-
156	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	-	EA	10	-
157					
158	OMIT				
159	Automatic bi-parting gates; Assumed 6'-0" wide (11 Cars x 4 Doors = 44 No. per platform)	(88)	EA	15,000	(1,320,000)
160	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	(86)	EA	10,500	(903,000)
161	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
162	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
163	Fixed Panels including framing and support; 4'-6" High	(1,980)	SF	750	(1,485,000)
164	Spare Parts - Approx. 10% of Material Cost	(1)	LS	228,000	(228,000)
165	Platform Edge Reconstruction work	(1)	LS	263,815	(263,815)
166	Remove allowance for cast in sleeves for LV & HV power	(360)	EA	110	(39,600)
167	Conduit running under Platform Edge	(1,242)	LF	30	(37,260)
169	Allow loss of production to work at night say 50%	1	LS	1,035,039	1,035,039
170					
171					
172	PREMIUM ASSOCIATED WITH PSD's				4,485,167

STATION: VERNON BLVD - JACKSON AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	633	LF		
5	LENGTH OF THE PLATFORM EDGE [FLUSHING BOUND] =	639	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,272	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,272	LF	7	8,904
13	Remove 5' wide section of 3" deep structural slab to platform edge	6,360	SF	12	76,320
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	128	CY	2,500	320,000
16	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,274	EA	25	31,850
17	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,274	EA	25	31,850
18	Cast in assemblies for PSD holding down bolts	704	EA	180	126,720
19	Polyethylene edge strip	1,272	LF	95	120,840
20	Provide sleeves for HV & LV wires	360	EA	110	39,600
21					
22	Platform edge finishes				
23	Demolition				
24	Remove existing tactile warning strip 2' wide	1,272	LF	15	19,080
25	Remove existing platform tiles	1,272	LF	12	15,264
26	Sawcut existing topping concrete at perimeter of removal area	1,272	LF	5	6,360
27	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,632	SF	8	61,056
28	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 12'-6" wide strip	572	SF	8	4,576
29	New Work				
30	New concrete topping to match existing	1,272	SF	15	19,080
31	New concrete topping at ADA boarding area to match existing	572	SF	15	8,580

STATION: VERNON BLVD - JACKSON AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	528	LF	110	58,080
33	Misc. patchwork	1	LS	50,000	50,000
34					
35	Equipment Room [7'-0" x 27'-0"]				
36	Build off existing Paid Area Slab; 3 Walls only		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
38	CMU Wall for equipment room	410	SF	45	18,450
39	Vertical connections with existing structure	20	LF	25	500
40	Fire rated door including frame & hardware	1	EA	2,500	2,500
41	Exterior wall finish				
42	Ceramic Tiling to match existing	410	SF	40	16,400
43	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
44	Concrete cove to match existing	41	LF	20	820
45	Interior Wall Finish - Paint	410	SF	5	2,050
46	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
47	Allow for 4" thick concrete pads for equipment	47	SF	20	945
48	Allowance for Mechanical Scope	1	LS	40,000	40,000
49	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
50	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
51	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
52					
53	Automatic Platform Gates [APGs] - 4'-6" High				
54	Automatic bi-parting gates; Assumed 6'-0" wide (11 Cars x 4 Doors = 44 No. per platform)	88	EA	15,000	1,320,000
55	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	86	EA	10,500	903,000
56	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
57	Platform End Gates (PEGs)	4	EA	13,000	52,000
58	Fixed Panels including framing and support; 4'-6" High	2,115	SF	750	1,586,250
59	Spare Parts - Approx. 10% of Material Cost	1	LS	234,075	234,075
60	Testing and commissioning	800	HRS	160	127,944
61	Product Warranty	1	LS	1,000,000	1,000,000
62	Allowance for Braille Signage	88	EA	2,500	220,000
63					
64	Electrical				
65	Electrical Upgrades				
66	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
67	Power and Lighting				
68	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

STATION: VERNON BLVD - JACKSON AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
69	Allow for conduit / cable runs for power and communications under platform edge	1,272	LF	60	76,320
	PSD Connections	1	LS	75,000	75,000
71	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
72	Power to PSD Room from EDR including track crossing if needed	600	LF	60	36,000
73	Reserve power to PSD Room from EDR including track crossing if needed	600	LF	60	36,000
74	No allowance for new lighting as if APG's are used		Note		EXCL.
75	Grounding				
76	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
77	MISC				
78	Testing and commissioning	1	LS	30,000	30,000
79	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
80					
81	Communications				
82	FA System				
83	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
84	CCTV coverage				
85	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	110	EA	12,000	1,320,000
86	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
87	Berthing Technology Sensors				
88	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	11	EA	16,000	176,000
89	Train Door Detection System				
90	Train Door Detection Sensor including software and hardware requirements	11	EA	15,000	165,000
91	Entrapment concerns				
92	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	264	EA	4,629	1,222,119
93	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	264	EA	5,566	1,469,309
94	Engineering and Testing	2,000	Hrs	160	319,860
95	Centralized monitoring/control				
96	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
97	MISC				
98	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for IRT Flushing Line Stations in Queens

5-Jul-18

STATION: VERNON BLVD - JACKSON AVE

ITEM	DESCRIPTION OF WORK	QTY (UNIT)	MEAS (UNIT)	UNIT COST	TOTAL STATION COST
99	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
100	Site Survey and Inspections	1	LS	100,000	100,000
101	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
102	Furnish Test Equipment allowance	1	LS	500,000	500,000
103	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
104					
105	Out of hours Work				
106	No allowance included for work outside normal working hours		Note		EXCL.
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Allow loss of production to work at night say 50%	1	LS	4,023,044	4,023,044
113	TOTAL PSD WORK:				$ 17,433,191

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (11 Cars x 4 Doors = 44 No. per platform)	88	EA	25,000	2,200,000
122	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	86	EA	15,000	1,290,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,830	SF	750	3,622,401
126	Spare Parts - Approx. 10% of Material Cost	1	LS	434,664	434,664
127	Structual framing / bracing				
					5-Jul-18
	STATION: VERNON BLVD - JACKSON AVE				
ITEM	DESCRIPTION OF WORK	QTY	MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				

5-Jul-18

STATION: VERNON BLVD - JACKSON AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
137	Automatic bi-parting gates; Assumed 6'-0" wide (11 Cars x 4 Doors = 44 No. per platform)	(88)	EA	15,000	(1,320,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	(86)	EA	10,500	(903,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
141	Fixed Panels including framing and support; 4'-6" High	(2,115)	SF	750	(1,586,250)
142	Spare Parts - Approx. 10% of Material Cost	(1)	LS	234,075	(234,075)
143	Platform Edge Reconstruction work	(1)	LS	586,740	(586,740)
144	Remove allowance for cast in sleeves for LV & HV power	(360)	EA	110	(39,600)
145	Conduit running under Platform Edge	(1,272)	LF	30	(38,160)
146					
147	Allow loss of production to work at night say 50%	1	LS	1,018,738	1,018,738
148					
149	PREMIUM ASSOCIATED WITH PSD's				4,414,533

STATION: 42ND STREET - GRAND CENTRAL

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	645	LF		
5	LENGTH OF THE PLATFORM EDGE [FLUSHING BOUND] =	645	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,290	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,290	LF	7	9,030
13	Remove 5' wide section of 3" deep structural slab to platform edge	6,450	SF	12	77,400
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	130	CY	2,500	325,000
16	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,292	EA	25	32,300
17	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,292	EA	25	32,300
18	Cast in assemblies for PSD holding down bolts	704	EA	180	126,720
19	Polyethylene edge strip	1,290	LF	95	122,550
20	Provide sleeves for HV & LV wires	360	EA	110	39,600
21					
22	Platform edge finishes				
23	Demolition				
24	Remove existing tactile warning strip 2' wide	1,290	LF	15	19,350
25	Remove existing platform tiles	1,290	LF	12	15,480
26	Sawcut existing topping concrete at perimeter of removal area	1,290	LF	5	6,450
27	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,740	SF	8	61,920
28	Remove existing 3" concrete topping at 44' long ADA boarding area; Platform width i.e. 21' wide strip at ADA boarding area	396	SF	8	3,168
29	New Work				
30	New concrete topping to match existing	1,290	SF	15	19,350
31	New concrete topping at ADA boarding area to match existing	396	SF	15	5,940

STATION: 42ND STREET - GRAND CENTRAL

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	528	LF	110	58,080
33	Misc. patchwork	1	LS	50,000	50,000
34					
35	Equipment Room [7'-0" x 27'-0"]				
36	Build off existing platform slab		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	68	LF	90	6,120
38	CMU Wall for equipment room	680	SF	45	30,600
39	Vertical connections with existing structure	-	LF	25	-
40	Fire rated door including frame & hardware	1	EA	2,500	2,500
41	Exterior wall finish				
42	Ceramic Tiling to match existing	680	SF	40	27,200
43	Mosaic Band to match existing - Assuming 8" high	68	LF	120	8,160
44	Concrete cove to match existing	68	LF	20	1,360
45	Interior Wall Finish - Paint	680	SF	5	3,400
46	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
47	Allow for 4" thick concrete pads for equipment	47	SF	20	945
48	Allowance for Mechanical Scope	1	LS	40,000	40,000
49	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
50	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
51	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
52					
53	Automatic Platform Gates [APGs] - 4'-6" High				
54	Automatic bi-parting gates; Assumed 6'-0" wide (11 Cars x 4 Doors = 44 No. per platform)	88	EA	15,000	1,320,000
55	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	86	EA	10,500	903,000
56	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
57	Platform End Gates (PEGs)	4	EA	13,000	52,000
58	Fixed Panels including framing and support; 4'-6" High	2,196	SF	750	1,647,000
59	Spare Parts - Approx. 10% of Material Cost	1	LS	237,720	237,720
60	Testing and commissioning	800	HRS	160	127,944
61	Product Warranty	1	LS	1,000,000	1,000,000
62	Allowance for Braille Signage	88	EA	2,500	220,000
63					
64	Electrical				
65	Electrical Upgrades				
66	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
67	Power and Lighting				
68	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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STATION: 42ND STREET - GRAND CENTRAL

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
69	Allow for conduit / cable runs for power and communications under platform edge	1,290	LF	60	77,400
	PSD Connections	1	LS	75,000	75,000
71	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
72	Power to PSD Room from EDR including track crossing if needed	600	LF	60	36,000
73	Reserve power to PSD Room from EDR including track crossing if needed	600	LF	60	36,000
74	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
75	Grounding				
76	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
77	MISC				
78	Testing and commissioning	1	LS	30,000	30,000
79	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
80					
81	Communications				
82	FA System				
83	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
84	CCTV coverage				
85	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	110	EA	12,000	1,320,000
86	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
87	Berthing Technology Sensors				
88	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	11	EA	16,000	176,000
89	Train Door Detection System				
90	Train Door Detection Sensor including software and hardware requirements	11	EA	15,000	165,000
91	Entrapment concerns				
92	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	264	EA	4,629	1,222,119
93	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	264	EA	5,566	1,469,309
94	Engineering and Testing	2,000	Hrs	160	319,860
95	Centralized monitoring/control				
96	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
97	MISC				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for IRT Flushing Line Stations in Queens

5-Jul-18

STATION: 42ND STREET - GRAND CENTRAL

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
98	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
99	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
100	Site Survey and Inspections	1	LS	100,000	100,000
101	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
102	Furnish Test Equipment allowance	1	LS	500,000	500,000
103	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
104					
105	Out of hours Work				
106	No allowance included for work outside normal working hours		Note		EXCL.
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Allow loss of production to work at night say 50%	1	LS	4,053,633	4,053,633
113	TOTAL PSD WORK:				$ 17,565,743

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (11 Cars x 4 Doors = 44 No. per platform)	88	EA	25,000	2,200,000
122	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	86	EA	15,000	1,290,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,974	SF	750	3,730,401
126	Spare Parts - Approx. 10% of Material Cost	1	LS	441,144	441,144
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	85,577
129	L6x6x1/2 continuous angle	9	TONS	17,500	166,152
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Platform Edge Repair				
132	Remove concrete platform edge	1,290	LF	27	34,830
133	Platform edge repair	1,290	LF	109	140,610
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	720	EA	10	7,200
135					
136	OMIT				

STATION: 42ND STREET - GRAND CENTRAL

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
137	Automatic bi-parting gates; Assumed 6'-0" wide (11 Cars x 4 Doors = 44 No. per platform)	(88)	EA	15,000	(1,320,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	(86)	EA	10,500	(903,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
141	Fixed Panels including framing and support; 4'-6" High	(2,196)	SF	750	(1,647,000)
142	Spare Parts - Approx. 10% of Material Cost	(1)	LS	237,720	(237,720)
143	Platform Edge Reconstruction work	(1)	LS	593,720	(593,720)
144	Remove allowance for cast in sleeves for LV & HV power	(360)	EA	110	(39,600)
145	Conduit running under Platform Edge	(1,290)	LF	30	(38,700)
146					
147	Allow loss of production to work at night say 50%	1	LS	1,033,291	1,033,291
148					
149	PREMIUM ASSOCIATED WITH PSD's				4,477,592

STATION: 5TH AVENUE - BRYANT PARK

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	578	LF		
5	LENGTH OF THE PLATFORM EDGE [FLUSHING BOUND] =	576	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,154	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,154	LF	7	8,078
13	Remove 5' wide section of 3" deep structural slab to platform edge	5,770	SF	12	69,240
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	116	CY	2,500	290,000
16	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,156	EA	25	28,900
17	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,156	EA	25	28,900
18	Cast in assemblies for PSD holding down bolts	704	EA	180	126,720
19	Polyethylene edge strip	1,154	LF	95	109,630
20	Provide sleeves for HV & LV wires	360	EA	110	39,600
21					
22	Platform edge finishes				
23	Demolition				
24	Remove existing tactile warning strip 2' wide	1,154	LF	15	17,310
25	Remove existing platform tiles	1,154	LF	12	13,848
26	Sawcut existing topping concrete at perimeter of removal area	1,154	LF	5	5,770
27	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,924	SF	8	55,392
28	Remove existing 3" concrete topping at 44' long ADA boarding area; Platform width i.e. 18'-6" wide strip at ADA boarding area	286	SF	8	2,288
29	New Work				
30	New concrete topping to match existing	1,154	SF	15	17,310
31	New concrete topping at ADA boarding area to match existing	286	SF	15	4,290

STATION: 5TH AVENUE - BRYANT PARK

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	528	LF	110	58,080
33	Misc. patchwork	1	LS	50,000	50,000
34					
35	Equipment Room [7'-0" x 27'-0"]				
36	Build off existing Mezzanine Slab; 3 Walls only		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
38	CMU Wall for equipment room	410	SF	45	18,450
39	Vertical connections with existing structure	20	LF	25	500
40	Fire rated door including frame & hardware	1	EA	2,500	2,500
41	Exterior wall finish				
42	Ceramic Tiling to match existing	410	SF	40	16,400
43	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
44	Concrete cove to match existing	41	LF	20	820
45	Interior Wall Finish - Paint	410	SF	5	2,050
46	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
47	Allow for 4" thick concrete pads for equipment	47	SF	20	945
48	Allowance for Mechanical Scope	1	LS	40,000	40,000
49	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
50	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
51	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
53	Automatic Platform Gates [APGs] - 4'-6" High				
54	Automatic bi-parting gates; Assumed 6'-0" wide (11 Cars x 4 Doors = 44 No. per platform)	88	EA	15,000	1,320,000
55	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	86	EA	10,500	903,000
56	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
57	Platform End Gates (PEGs)	4	EA	13,000	52,000
58	Fixed Panels including framing and support; 4'-6" High	1,584	SF	750	1,188,000
59	Spare Parts - Approx. 10% of Material Cost	1	LS	210,180	210,180
60	Testing and commissioning	800	HRS	160	127,944
61	Product Warranty	1	LS	1,000,000	1,000,000
62	Allowance for Braille Signage	88	EA	2,500	220,000
63					
64	Electrical				
65	Electrical Upgrades				
66	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
67	Power and Lighting				
68	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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STATION: 5TH AVENUE - BRYANT PARK

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
69	Allow for conduit / cable runs for power and communications under platform edge	1,154	LF	60	69,240
	PSD Connections	1	LS	75,000	75,000
71	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
72	Power to PSD Room from EDR including track crossing if needed	200	LF	60	12,000
73	Reserve power to PSD Room from EDR including track crossing if needed	600	LF	60	36,000
74	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
75	Grounding				
76	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
77	MISC				
78	Testing and commissioning	1	LS	30,000	30,000
79	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
80					
81	Communications				
82	FA System				
83	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
84	CCTV coverage				
85	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	110	EA	12,000	1,320,000
86	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
87	Berthing Technology Sensors				
88	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	11	EA	16,000	176,000
89	Train Door Detection System				
90	Train Door Detection Sensor including software and hardware requirements	11	EA	15,000	165,000
91	Entrapment concerns				
92	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	264	EA	4,629	1,222,119
93	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	264	EA	5,566	1,469,309
94	Engineering and Testing	2,000	Hrs	160	319,860
95	Centralized monitoring/control				
96	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
97	MISC				

STATION: 5TH AVENUE - BRYANT PARK

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
98	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
99	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
100	Site Survey and Inspections	1	LS	100,000	100,000
101	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
102	Furnish Test Equipment allowance	1	LS	500,000	500,000
103	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
104					
105	Out of hours Work				
106	No allowance included for work outside normal working hours		Note		EXCL.
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Allow loss of production to work at night say 50%	1	LS	3,865,235	3,865,235
113	TOTAL PSD WORK:				$ 16,749,354

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (11 Cars x 4 Doors = 44 No. per platform)	88	EA	25,000	2,200,000
122	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	86	EA	15,000	1,290,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	3,886	SF	750	2,914,401
126	Spare Parts - Approx. 10% of Material Cost	1	LS	392,184	392,184
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	76,692
129	L6x6x1/2 continuous angle	8	TONS	17,500	148,635
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Platform Edge Repair				
132	Remove concrete platform edge	1,154	LF	27	31,158
133	Platform edge repair	1,154	LF	109	125,786
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	720	EA	10	7,200
135					
136	OMIT				

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STATION: 5TH AVENUE - BRYANT PARK

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
137	Automatic bi-parting gates; Assumed 6'-0" wide (11 Cars x 4 Doors = 44 No. per platform)	(88)	EA	15,000	(1,320,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	(86)	EA	10,500	(903,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
141	Fixed Panels including framing and support; 4'-6" High	(1,584)	SF	750	(1,188,000)
142	Spare Parts - Approx. 10% of Material Cost	(1)	LS	210,180	(210,180)
143	Platform Edge Reconstruction work	(1)	LS	543,760	(543,760)
144	Remove allowance for cast in sleeves for LV & HV power	(360)	EA	110	(39,600)
145	Conduit running under Platform Edge	(1,154)	LF	30	(34,620)
146					
147	Allow loss of production to work at night say 50%	1	LS	922,507	922,507
148					
149	PREMIUM ASSOCIATED WITH PSD's				3,997,532

STATION: 42ND STREET - TIMES SQUARE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	563	LF		
5	LENGTH OF THE PLATFORM EDGE [FLUSHING BOUND] =	563	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,126	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,126	LF	7	7,882
13	Remove 5' wide section of 3" deep structural slab to platform edge	5,630	SF	12	67,560
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	113	CY	2,500	282,500
16	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,128	EA	25	28,200
17	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,128	EA	25	28,200
18	Cast in assemblies for PSD holding down bolts	704	EA	180	126,720
19	Polyethylene edge strip	1,126	LF	95	106,970
20	Provide sleeves for HV & LV wires	360	EA	110	39,600
21					
22	Platform edge finishes				
23	Demolition				
24	Remove existing tactile warning strip 2' wide	1,126	LF	15	16,890
25	Remove existing platform tiles	1,126	LF	12	13,512
26	Sawcut existing topping concrete at perimeter of removal area	1,126	LF	5	5,630
27	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,756	SF	8	54,048
28	Remove existing 3" concrete topping at 44' long ADA boarding area; Platform width i.e. 28'-6" wide strip at ADA boarding area	726	SF	8	5,808
29	New Work				
30	New concrete topping to match existing	1,126	SF	15	16,890
31	New concrete topping at ADA boarding area to match existing	726	SF	15	10,890

STATION: 42ND STREET - TIMES SQUARE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	528	LF	110	58,080
33	Misc. patchwork	1	LS	50,000	50,000
34					
35	Equipment Room [7'-0" x 27'-0"]				
36	Build off existing platform slab; 2 Walls only		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	34	LF	90	3,060
38	CMU Wall for equipment room	340	SF	45	15,300
39	Vertical connections with existing structure	20	LF	25	500
40	Fire rated door including frame & hardware	1	EA	2,500	2,500
41	Exterior wall finish				
42	Ceramic Tiling to match existing	340	SF	40	13,600
43	Mosaic Band to match existing - Assuming 8" high	34	LF	120	4,080
44	Concrete cove to match existing	34	LF	20	680
45	Interior Wall Finish - Paint	340	SF	5	1,700
46	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
47	Allow for 4" thick concrete pads for equipment	47	SF	20	945
48	Allowance for Mechanical Scope	1	LS	40,000	40,000
49	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
50	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
51	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
52					
53	Automatic Platform Gates [APGs] - 4'-6" High				
54	Automatic bi-parting gates; Assumed 6'-0" wide (11 Cars x 4 Doors = 44 No. per platform)	88	EA	15,000	1,320,000
55	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	86	EA	10,500	903,000
56	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
57	Platform End Gates (PEGs)	4	EA	13,000	52,000
58	Fixed Panels including framing and support; 4'-6" High	1,458	SF	750	1,093,500
59	Spare Parts - Approx. 10% of Material Cost	1	LS	204,510	204,510
60	Testing and commissioning	800	HRS	160	127,944
61	Product Warranty	1	LS	1,000,000	1,000,000
62	Allowance for Braille Signage	88	EA	2,500	220,000
63					
64	Electrical				
65	Electrical Upgrades				
66	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
67	Power and Lighting				
68	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

STATION: 42ND STREET - TIMES SQUARE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
69	Allow for conduit / cable runs for power and communications under platform edge	1,126	LF	60	67,560
	PSD Connections	1	LS	75,000	75,000
71	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
72	Power to PSD Room from EDR including track crossing if needed	800	LF	60	48,000
73	Reserve power to PSD Room from EDR including track crossing if needed	600	LF	60	36,000
74	No allowance for new lighting as if APG's are used		Note		EXCL.
75	Grounding				
76	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
77	MISC				
78	Testing and commissioning	1	LS	30,000	30,000
79	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
80					
81	Communications				
82	FA System				
83	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
84	CCTV coverage				
85	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	110	EA	12,000	1,320,000
86	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
87	Berthing Technology Sensors				
88	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	11	EA	16,000	176,000
89	Train Door Detection System				
90	Train Door Detection Sensor including software and hardware requirements	11	EA	15,000	165,000
91	Entrapment concerns				
92	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	264	EA	4,629	1,222,119
93	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	264	EA	5,566	1,469,309
94	Engineering and Testing	2,000	Hrs	160	319,860
95	Centralized monitoring/control				
96	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
97	MISC				
98	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000

STATION: 42ND STREET - TIMES SQUARE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
99	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
100	Site Survey and Inspections	1	LS	100,000	100,000
101	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
102	Furnish Test Equipment allowance	1	LS	500,000	500,000
103	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
104					
105	Out of hours Work				
106	No allowance included for work outside normal working hours		Note		EXCL.
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Allow loss of production to work at night say 50%	1	LS	3,841,315	3,841,315
113	TOTAL PSD WORK:				$ 16,645,697

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (11 Cars x 4 Doors = 44 No. per platform)	88	EA	25,000	2,200,000
122	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	86	EA	15,000	1,290,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	3,662	SF	750	2,746,401
126	Spare Parts - Approx. 10% of Material Cost	1	LS	382,104	382,104
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	74,863
129	L6x6x1/2 continuous angle	8	TONS	17,500	145,029
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Platform Edge Repair				
132	Remove concrete platform edge	1,126	LF	27	30,402
133	Platform edge repair	1,126	LF	109	122,734
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	720	EA	10	7,200
135					
136	OMIT				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for IRT Flushing Line Stations in Queens

5-Jul-18

STATION: 42ND STREET - TIMES SQUARE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
137	Automatic bi-parting gates; Assumed 6'-0" wide (11 Cars x 4 Doors = 44 No. per platform)	(88)	EA	15,000	(1,320,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	(86)	EA	10,500	(903,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
141	Fixed Panels including framing and support; 4'-6" High	(1,458)	SF	750	(1,093,500)
142	Spare Parts - Approx. 10% of Material Cost	(1)	LS	204,510	(204,510)
143	Platform Edge Reconstruction work	(1)	LS	533,180	(533,180)
144	Remove allowance for cast in sleeves for LV & HV power	(360)	EA	110	(39,600)
145	Conduit running under Platform Edge	(1,126)	LF	30	(33,780)
146					
147	Allow loss of production to work at night say 50%	1	LS	899,787	899,787
148					
149	PREMIUM ASSOCIATED WITH PSD's				3,899,079

STATION: 34TH STREET - HUDSON YARDS

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	600	LF		
5	LENGTH OF THE PLATFORM EDGE [FLUSHING BOUND] =	600	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,200	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,200	LF	7	8,400
13	Remove 5' wide section of 3" deep structural slab to platform edge	6,000	SF	12	72,000
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	121	CY	2,500	302,500
16	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,202	EA	25	30,050
17	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,202	EA	25	30,050
18	Cast in assemblies for PSD holding down bolts	704	EA	180	126,720
19	Polyethylene edge strip	1,200	LF	95	114,000
20	Provide sleeves for HV & LV wires	360	EA	110	39,600
21					
22	Platform edge finishes				
23	Demolition				
24	Remove existing tactile warning strip 2' wide	1,200	LF	15	18,000
25	Remove existing platform tiles	1,200	LF	12	14,400
26	Sawcut existing topping concrete at perimeter of removal area	1,200	LF	5	6,000
27	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,200	SF	8	57,600
28	Remove existing 3" concrete topping at 44' long ADA boarding area; Platform width i.e. 28'-6" wide strip at ADA boarding area	726	SF	8	5,808
29	New Work				
30	New concrete topping to match existing	1,200	SF	15	18,000
31	New concrete topping at ADA boarding area to match existing	726	SF	15	10,890

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for IRT Flushing Line Stations in Queens

5-Jul-18

STATION: 34TH STREET - HUDSON YARDS

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	528	LF	110	58,080
33	Misc. patchwork	1	LS	50,000	50,000
34					
35	Equipment Room A [7'-0" x 27'-0"]				
36	Form 8" wide concrete curb including dowelling to platform slab	68	LF	90	6,120
37	CMU Wall for equipment room	680	SF	45	30,600
38	Fire rated door including frame & hardware	1	EA	2,500	2,500
39	Exterior wall finish				
40	Ceramic Tiling to match existing	680	SF	40	27,200
41	Mosaic Band to match existing - Assuming 8" high	68	LF	120	8,160
42	Concrete cove to match existing	68	LF	20	1,360
43	Interior Wall Finish - Paint	680	SF	5	3,400
44	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
45	Allow for 4" thick concrete pads for equipment	47	SF	20	945
46	Allowance for Mechanical Scope	1	LS	40,000	40,000
47	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
48	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
49	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
50					
51	Equipment Room B [7'-0" x 27'-0"]				
52	Form 8" wide concrete curb including dowelling to platform slab	68	LF	90	6,120
53	CMU Wall for equipment room	680	SF	45	30,600
54	Fire rated door including frame & hardware	1	EA	2,500	2,500
55	Exterior wall finish				
56	Ceramic Tiling to match existing	680	SF	40	27,200
57	Mosaic Band to match existing - Assuming 8" high	68	LF	120	8,160
58	Concrete cove to match existing	68	LF	20	1,360
59	Interior Wall Finish - Paint	680	SF	5	3,400
60	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
61	Allow for 4" thick concrete pads for equipment	47	SF	20	945
62	Allowance for Mechanical Scope	1	LS	40,000	40,000
63	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
64	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
65	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
66					
67	Automatic Platform Gates [APGs] - 4'-6" High				
68	Automatic bi-parting gates; Assumed 6'-0" wide (11 Cars x 4 Doors = 44 No. per platform)	88	EA	15,000	1,320,000
69	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	86	EA	10,500	903,000

5-Jul-18

STATION: 34TH STREET - HUDSON YARDS

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
70	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
71	Platform End Gates (PEGs)	4	EA	13,000	52,000
72	Fixed Panels including framing and support; 4'-6" High	1,791	SF	750	1,343,250
73	Spare Parts - Approx. 10% of Material Cost	1	LS	219,495	219,495
74	Testing and commissioning	800	HRS	160	127,944
75	Product Warranty	1	LS	1,000,000	1,000,000
76	Allowance for Braille Signage	88	EA	2,500	220,000
77					
78	Electrical				
79	Electrical Upgrades				
80	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
81	Power and Lighting				
82	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
83	Allow for conduit / cable runs for power and communications under platform edge	1,200	LF	60	72,000
	PSD Connections	1	LS	75,000	75,000
85	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
86	Power to PSD Rooms from EDR [Conduit & Cable]	1,200	LF	60	72,000
87	Reserve power to PSD Room from EDR [Conduit & Cable]	1,200	LF	60	72,000
88	No allowance for new lighting as if APG's are used		Note		EXCL.
89	Grounding				
90	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
91	MISC				
92	Testing and commissioning	1	LS	30,000	30,000
93	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
94					
95	Communications				
96	FA System				
97	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
98	CCTV coverage				
99	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	110	EA	12,000	1,320,000
100	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
101	Berthing Technology Sensors				
102	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	11	EA	16,000	176,000
103	Train Door Detection System				
104	Train Door Detection Sensor including software and hardware requirements	11	EA	15,000	165,000
105	Entrapment concerns				

STATION: 34TH STREET - HUDSON YARDS

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
106	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	264	EA	4,629	1,222,119
107	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	264	EA	5,566	1,469,309
108	Engineering and Testing	2,000	Hrs	160	319,860
109	Centralized monitoring/control				
110	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
111	MISC				
112	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
113	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
114	Site Survey and Inspections	1	LS	100,000	100,000
115	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
116	Furnish Test Equipment allowance	1	LS	500,000	500,000
117	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
118					
119	Out of hours Work				
120	No allowance included for work outside normal working hours		Note		EXCL.
121					
122	Training				
123	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
124					
125	Allow loss of production to work at night say 50%	1	LS	4,053,695	4,053,695
127	TOTAL PSD WORK:				$ 17,566,010

129					
130	ADD ALTERNATIVE				
131					
132	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
133					
134	ADD				
135	Automatic bi-parting doors (11 Cars x 4 Doors = 44 No. per platform)	88	EA	25,000	2,200,000
136	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	86	EA	15,000	1,290,000
137	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
138	Platform End Gates (PEGs)	4	EA	18,000	72,000

5-Jul-18

STATION: 34TH STREET - HUDSON YARDS

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
139	Fixed Panels including framing and support; Assuming 8'-0" high	4,254	SF	750	3,190,401
140	Spare Parts - Approx. 10% of Material Cost	1	LS	408,744	408,744
141	Structual framing / bracing				
142	HSS4x4x1/2 hanger	5	TONS	17,500	79,697
143	L6x6x1/2 continuous angle	9	TONS	17,500	154,560
144	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
145	Platform Edge Repair				
146	Remove concrete platform edge	1,200	LF	27	32,400
147	Platform edge repair	1,200	LF	109	130,800
148	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	720	EA	10	7,200
149					
150	OMIT				
151	Automatic bi-parting gates; Assumed 6'-0" wide (11 Cars x 4 Doors = 44 No. per platform)	(88)	EA	15,000	(1,320,000)
152	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #43 per Platform	(86)	EA	10,500	(903,000)
153	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
154	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
155	Fixed Panels including framing and support; 4'-6" High	(1,791)	SF	750	(1,343,250)
156	Spare Parts - Approx. 10% of Material Cost	(1)	LS	219,495	(219,495)
157	Platform Edge Reconstruction work	(1)	LS	561,320	(561,320)
158	Remove allowance for cast in sleeves for LV & HV power	(360)	EA	110	(39,600)
159	Conduit running under Platform Edge	(1,200)	LF	30	(36,000)
160					
161	Allow loss of production to work at night say 50%	1	LS	959,780	959,780
162					
163					
164	PREMIUM ASSOCIATED WITH PSD's				4,159,045

New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR ‘A and C SERVICE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

FINAL SUBMITTAL DATE: August 8, 2019

STV 100 Years

Table of Contents

Appendices

Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. Our Tier 1 analysis found no instances of door misalignment between car classes for this line (Note that the Rockaway Park shuttle – a half-length train – will need to revise its stopping position to align with either the first or last five cars of the regular A-train). This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 66 newly evaluated stations, 25 have been found to be not suitable for the installation of PSDs. (34th Street / 8th Ave and Nostrand Ave are only feasible for the C and A train respectively. They are both counted as "feasible" in the overall tally)

> *[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to half-height barriers]*

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues: the platform edge barriers are 15" wide. Where an existing object (wall, stair, and railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Under the following conditions, PSDs are declared infeasible:
  - Limit the ability of a wheelchair to turn within a 5'-0" circle
  - Limit path of travel to less than a 32" pinch width (defined as an obstruction that measures less than 2'-0" longitudinally, i.e. columns)
  - Limit path of travel to be less than a 36" corridor as defined by the edge of a staircase, railing or room
- Insufficient space for the PSD equipment room: the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow: due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements regarding the placement of these new barriers in an existing station environment.
- Structural considerations: existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic

upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.

- Columns at platform edge: at certain stations, the columns are positioned 16" to 24" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space.

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the previously proposed 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the PSD barriers and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is used for refuse removal at most of the A/C-line stations. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the (off) loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in damage from these carts along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process.

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 62% of the 'A' & 'C' Line Stations. Total implementation cost would be $1.5B for APGs and $1.3B for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; that estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of $931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 41 feasible stations (plus six additional pairs of platforms at express stations), the aggregate annual maintenance cost would be $43.7M.

Summary Table

(62% Feasible 41/66)*

*MR164 and MR179 are both counted as feasible though only one of the two services is feasible at those stations

MRN No.	Station Names	Station Type	Platform Type	Feasibility	Issues/Reason for Failure	Cost APGs	Cost PSDs
143	207th Street Inwood	SUB	Island	No	Non-Compliant Egress Path	-	-
144	Dyckman Street 200th St.	SUB	Side	Yes	-	$31.8M	$41.3M
145	190th Street	SUB	Side	Yes	-	$31.9M	$41.1M
146	181st Street	SUB	Side	Yes	-	$32.1M	$41.2M
147	175th Street	SUB	Island	Yes	-	$31.9M	$40.5M
148	168th Street	SUB	Island	No	Non-Compliant Egress Path	-	-
149	163rd Street	SUB	Side	No	ADA Clearance	-	-
150	155th Street	SUB	Side	No	ADA Clearance	-	-
151	145th Street St. Nicholas Ave.	SUB	Island	No	ADA Clearance	-	-
152	135th Street	SUB	Side	Yes	-	$30.6M	$39.4 M
153A	125th Street – A-train	SUB	Island	Yes	-	$31.4M	$40.7M
153C	125th Street – C-train	SUB	Island	Yes		$31.4M	$40.7M
154	116th Street 8th Ave	SUB	Side	No	ADA Clearance	-	-
155	110th St. Cathedral Pkwy	SUB	Side	No	ADA Clearance	-	-
156	103rd Street	SUB	Side	No	ADA Clearance	-	-
157	96th Street	SUB	Side	Yes	-	$ 30.8M	$ 38.7M
158	86th Street	SUB	Side	No	ADA Clearance	-	-
159	81st St.	SUB	Side	No	ADA Clearance	-	-
160	72nd Street	SUB	Side	No	Non-Compliant Egress Path	-	-
161	59th Street Columbus Circle	SUB	Island	No	ADA Clearance	-	-
162	50th Street	SUB	Side	Yes	-	$32.0M	$42.3M
163	42nd Street	SUB	Island	No	ADA Clearance	-	-
164	34th Street Penn Station A	SUB	Island	No	ADA Clearance	-	-
164	34th Street Penn Station C	SUB	Side	Yes	-	$32.1M	$40.3M
165	23rd Street	SUB	Island	Yes	-	$32.0M	$40.8M
166A	14th Street - A-train	SUB	Island	Yes	-	$32.3M	$41.8M
166C	14th Street - C-train	SUB	Island	Yes		$32.3M	$41.4M
167A	West 4th St. – A-train	SUB	Island	Yes	-	$32.4M	$41.0M
167C	West 4th St. –C-train	SUB	Island	Yes		$32.4M	$41.0M
168	Spring Street	SUB	Side	Yes	-	$32.1M	$41.6M
169A	Canal Street - A-train	SUB	Island	Yes	-	$31.9M	$42.6M
169C	Canal Street - C-train	SUB	Island	Yes		$31.9M	$42.6M
170	Chambers Street	SUB	Island	No	ADA Clearance	-	-
172	Fulton St	SUB	Island	Yes	-	$31.9M	$40.2M
173	High St	SUB	Island	No	ADA Clearance	-	-
174	Jay St. Metro Tech	SUB	Island	No	ADA Clearance	-	-
175	Hoyt & Schemerhorn Sts.	SUB	Island	No	ADA Clearance	-	-
176	Lafayette Ave.	SUB	Side	Yes	-	$32.0M	$40.8M
177	Clinton & Washington Avenues	SUB	Side	Yes	-	$32.0M	$40.8M
178	Franklin Avenue	SUB	Side	Yes	-	$32.1M	$40.8M
179A	Nostrand Avenue A	SUB	Side	Yes	-	$32.1M	$43.3M
179C	Nostrand Avenue C	SUB	Side	No	ADA Clearance		
180	Kingston Throop Avenue	SUB	Side	Yes	-	$31.6M	$40.0M
181A	Utica Avenue - A-train	SUB	Island	Yes	-	$31.1M	$39.5M
181C	Utica Avenue - C-train	SUB	Island	Yes		$31.1M	$39.5M
182	Ralph Avenue	SUB	Side	Yes	-	$31.5M	$39.9M

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'A' & 'C' Line Stations

MRN No.	Station Names	Station Type	Platform Type	Feasibility	Issues/Reason for Failure	Cost APGs	Cost PSDs
183	Rockaway Avenue	SUB	Side	Yes	-	$32.8M	$42.1M
184A	Broadway Jct. – A-train	SUB	Island	Yes	-	$31.0M	$39.5M
184C	Broadway Jct. – C-train	SUB	Island	Yes		$31.0M	$39.5M
185	Liberty Avenue	SUB	Side	Yes	-	$30.9M	$38.9M
186	Van Siclen Avenue Pitkin Ave.	SUB	Side	Yes	-	$30.6M	$38.5M
187	Shepherd Avenue	SUB	Side	Yes		$30.9M	$38.9M
188	Euclid Avenue	SUB	Island	No	ADA Clearance	-	-
189	Grant Avenue	SUB	Island	No	ADA Clearance	-	-
190	80th St. Hudson Street	ELV	Side	No	ADA Clearance	-	-
191	88th Ave Boyd Avenue	ELV	Side	No	ADA Clearance	-	-
192	Rockaway Blvd.	ELV	Side	No	ADA Clearance	-	-
193	104th St. Oxford Avenue	ELV	Side	No	ADA Clearance	-	-
194	111th St. Greenwood Ave	ELV	Side	No	ADA Clearance	-	-
195	Lefferts Blvd. Ozone Park	ELV	Island	No	ADA Clearance	-	-
196	Aqueduct Race Track	GRA	Side	Yes	-	$22.3M	
197	Aqueduct North Conduit Ave	GRA	Side	Yes	-	$35.6M	
198	Howard Beach Airtrain	GRA	Side	Yes	-	$33.1M	
199	Broad Channel	VIA	Side	Yes	-	$32.6M	
200	Beach 90th St	VIA	Side	Yes	-	$32.4M	
201	Beach 98th St	VIA	Side	Yes	-	$35.9M	
202	Beach 105th St.	GRA	Side	Yes	-	$31.7M	
203	Rockaway Park	VIA	Island	Yes	-	$33.8M	
204	Beach 67th St.	VIA	Side	Yes	-	$32.1M	
205	Beach 60th St.	VIA	Side	Yes	-	$32.7M	
206	Beach 44th St.	VIA	Side	Yes	-	$32.5M	
207	Beach 36th St.	VIA	Side	Yes	-	$32.5M	
208	Beach 25th St	VIA	Side	Yes	-	$33.5M	
209	Far Rockaway / Mott Ave	VIA	Island	Yes	-	$32.4M	
					TOTAL	**$1.5B**	**$1.3B**

1.0 Station Assessments

1.01 – MR 143 | 207th Street Inwood

Summary: *207th Street Inwood Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the north end of the southbound platform as the existing width is 4'-8" (see figure 1).*

Description

207th Street Inwood Station is a below-grade station with one straight center / island platform. The platform structure is cast-in-place concrete. The width of the platform ranges from 23'-8' to 25'-6". The corridor width adjacent to the permanent "CED SCRUBBER ROOM "structure at the north end of the platform shown in photo below, is 4'-8" in width. Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

***Figure 1** – Non-Compliant egress condition*
207th Street Inwood Station

1.02 – MR 144 | Dyckman Street Station

Summary: *Dyckman Street Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG and PSD system (see Appendix B). Existing power is adequate.*

Description

The Dyckman Street Station is a below-grade station with two mildly curved side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are columns evenly distributed along the platform edge measuring 3'-4" from the platform edge. The platform widths measure approximately 11'-8" throughout. On the southbound platform there are two ceiling-mounted conductor monitors and one signal located above the platform edge, with a vertical clearance of at least 6'-8". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the northbound control area (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are nearly tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges are original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would be required for the installation of both APG and PSD systems.

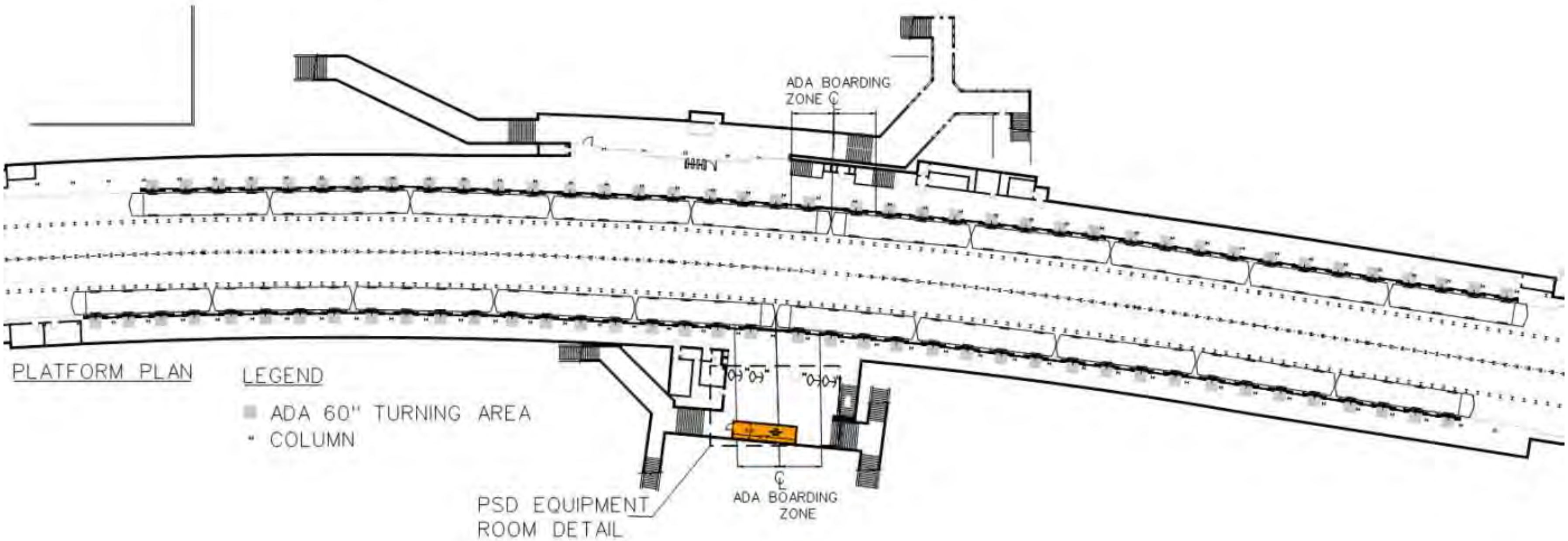

***Figure 1** – Overall plan*
Dyckman Street Station

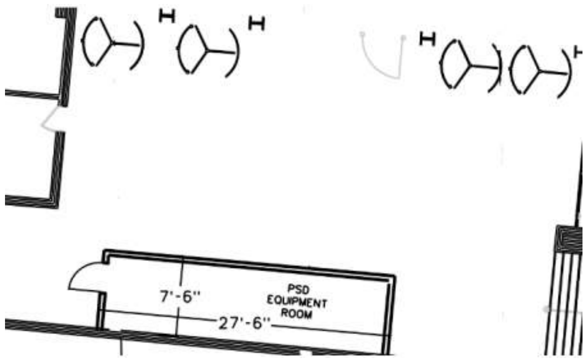

***Figure 2** – PSD Equipment Room Detail*
Dyckman Street 200th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear fluorescent fixtures mounted parallel to the platform edge. No alterations to the existing lighting configuration are anticipated.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal)

Station Name	Dyckman Street 200th St.
Peak Demand Load from ConEd Report, (kW)	60.4 (Combined)
Apparent Power (kVA)	75.5
Station Peak Demand Load, Max Current, (A)	209.7
Maximum Amount of Doors	80.0
PSD Total Load Including All Misc. Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	404
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	396
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve)

Station Name	Dyckman Street 200th St.
Peak Demand Load from ConEd Report, (kW)	60.4 (Combined)
Apparent Power (kVA)	75.5
Station Peak Demand Load, Max Current, (A)	209.7
Maximum Amount of Doors	80.0
PSD Total Load Including All Misc. Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	404
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	396
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 2. Power Capacity Analysis

***Figure 3** – General platform view*
Dyckman Street Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.8M to install APGs and $41.3 to install PSDs (See Appendix E)

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1.03 – MR 145 | 190th Street Station

Summary: *190th Street Station is feasible for both APGs and PSDs. There is one ceiling-mounted signal located at the center of the northbound platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG and PSD system (see Appendix B). Existing power is adequate.*

Description

The 190th Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. The platforms are column-free with the exception of six columns at the center of each platform which are 3'-4" from the platform edge. The platform widths vary from approximately 12'-0" to 15'-8". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the edge of the station mezzanine control area (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges are original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would be required for the installation of both APG and PSD systems.

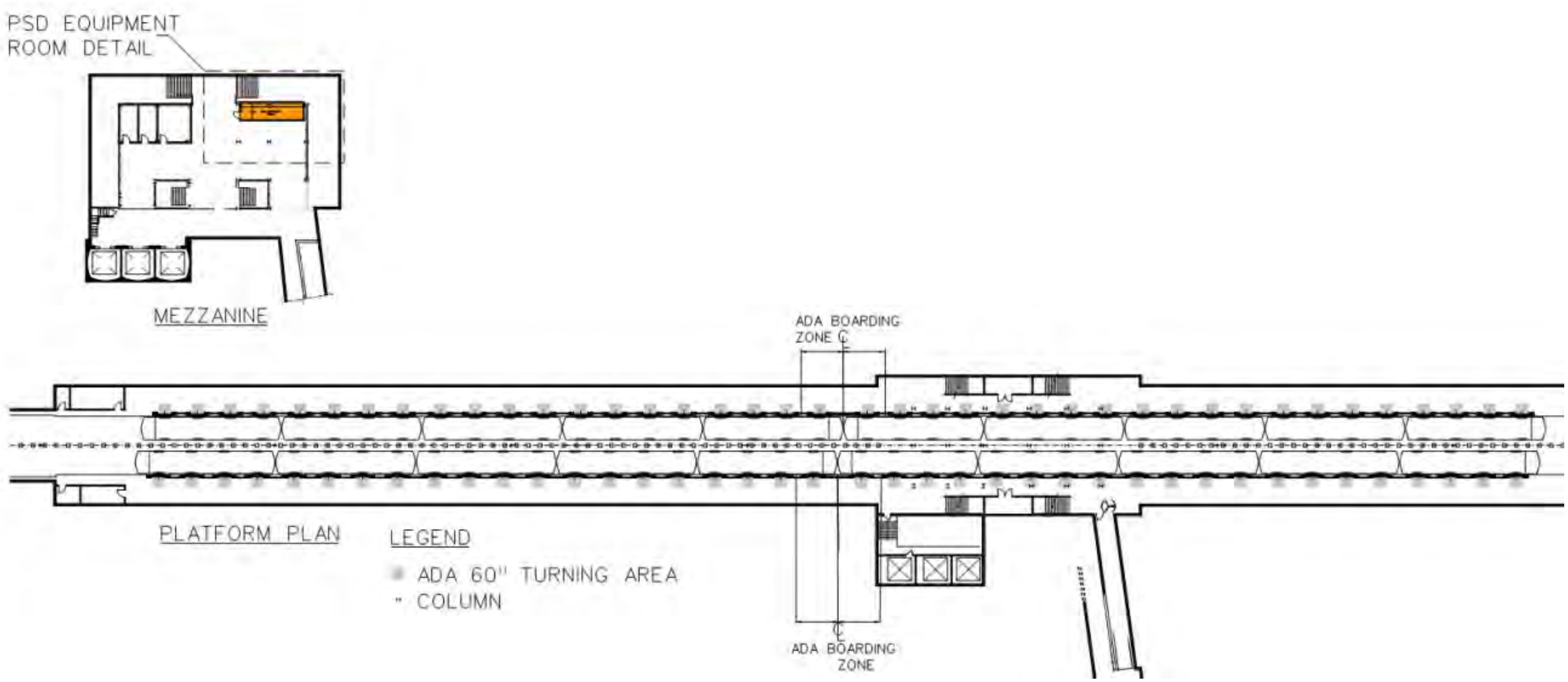

***Figure 1** – Overall plan*
190th Street Station

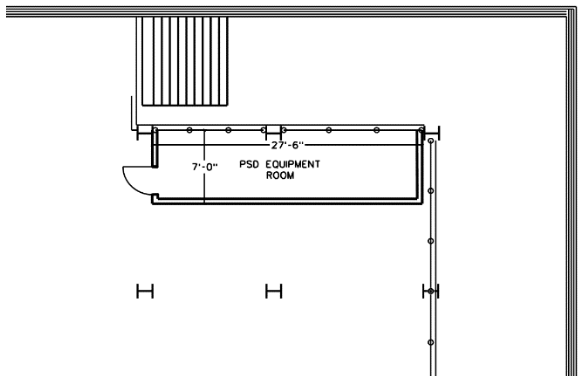

***Figure 2** – PSD Equipment Room Detail*
190th Street Ft. Washington Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Lighting:

Existing lighting: Throughout both platforms there are linear fluorescent fixtures mounted parallel to the platform edge. No alterations to the existing lighting configuration are anticipated.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal)

Station Name	190th Street Ft. Washington Ave.
Peak Demand Load from ConEd Report, (kW)	124.8
Apparent Power (kVA)	156.0
Station Peak Demand Load, Max Current, (A)	433.3
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	628
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	172
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis (Normal Service)

Station Power Capacity Analysis (Reserve)

Station Name	190th Street Ft. Washington Ave.
Peak Demand Load from ConEd Report, (kW)	124.8
Apparent Power (kVA)	156.0
Station Peak Demand Load, Max Current, (A)	433.3
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	628
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	172
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. No meter in Reserve EDR, but located in Con Ed vault per 1 line diagram. However, demand readings are combine for both Normal & Reserve.

Table 2. Power Capacity Analysis (Reserve Service)

Figure 3 *– General platform view*
190th Street Ft. Washington Avenue Station

Historic Restrictions:
The 190th Street station is a historically designated property. As such, design will require review by the New York State Historic Preservation Office.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.9M to install APGs and $41.1M to install PSDs (See Appendix E).

1.04 – MR 146 | 181st Street Station

Summary: *181st St Station is feasible for both APGs and PSDs. There is one ceiling-mounted signal located at the south end of the southbound platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG and PSD system (see Appendix B). Existing power is adequate.*

Description

The 181st St Station is a below-grade station with two mildly curved side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are seven columns at the northern end of the platforms measuring 3'-4" from the platform edge. The platform widths measure approximately 11'-8" throughout. Ceiling heights measure no less than 7'-6" throughout

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the edge of the station's northern mezzanine (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are nearly tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges are original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would be required for the installation of both APG and PSD systems.

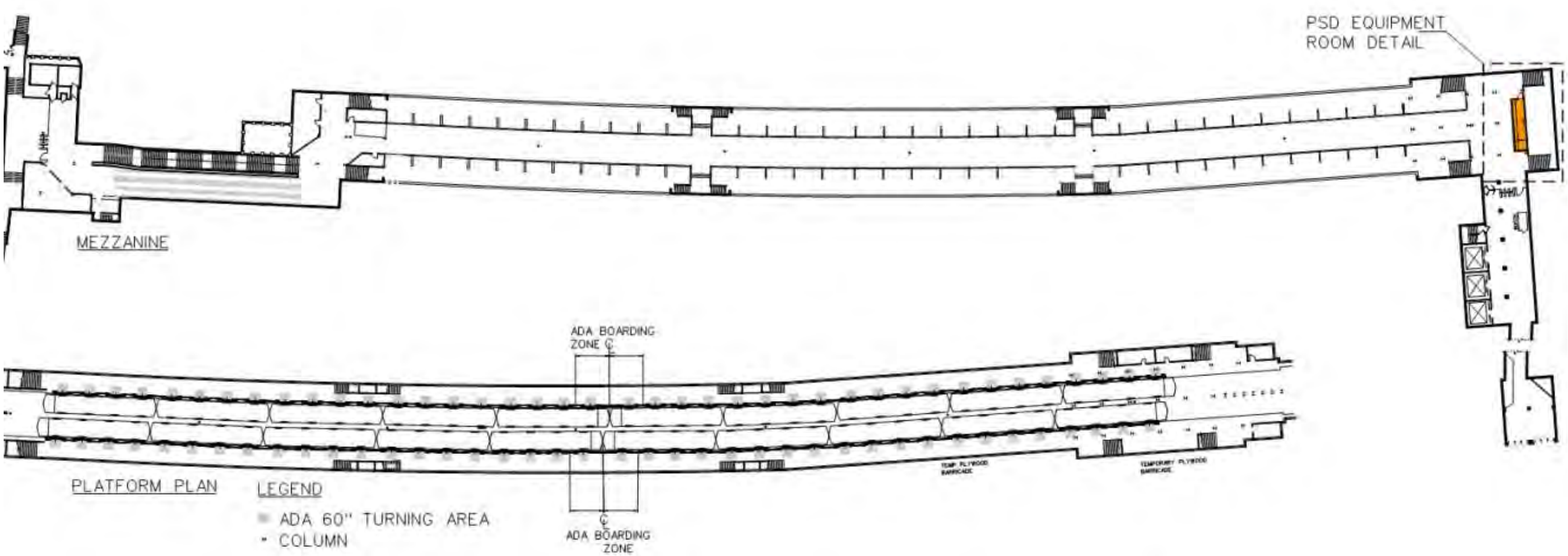

***Figure 1** – Overall plan*
181st Street Station

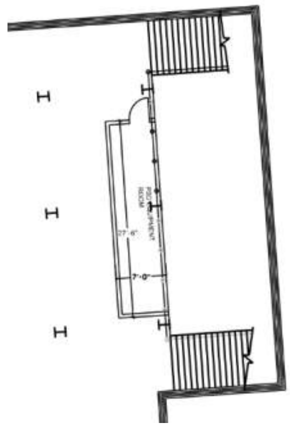

Figure 2 *– PSD Equipment Room Detail*
181st Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Lighting:

Existing lighting: Throughout both platforms there are linear fluorescent fixtures mounted parallel to the platform edge. No alterations to the existing lighting configuration are anticipated.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal)

Station Name	181st Street
Peak Demand Load from ConEd Report, (kW)	102.8
Apparent Power (kVA)	128.5
Station Peak Demand Load, Max Current, (A)	357.0
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	552
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	248
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis (Normal Service)

Station Power Capacity Analysis (Reserve)

Station Name	181st Street
Peak Demand Load from ConEd Report, (kW)	102.8
Apparent Power (kVA)	128.5
Station Peak Demand Load, Max Current, (A)	357.0
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	552
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	248
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve

Table 2. Power Capacity Analysis (Reserve Service)

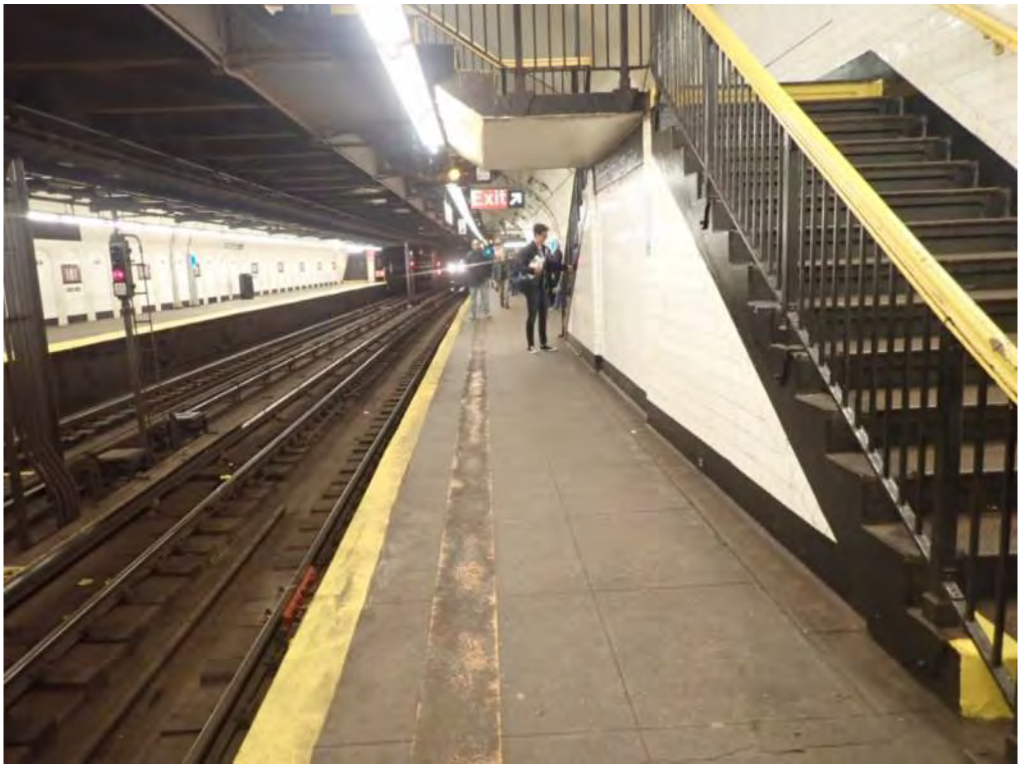

***Figure 3** – General platform view*
181st St Station

Historic Restrictions:
The 181st Street station is a historically designated property. As such, design will require review by the New York State Historic Preservation Office.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.1M to install APGs and $41.2M to install PSDs (See Appendix E)

1.05 – MR 147 | 175th Street Station

Summary: *175th Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG and PSD system (see Appendix B). Existing power is adequate.*

Description

175th Street Station is a below-grade station with one center / island platform (**see Figure 1)**. The platform structure is cast-in-place concrete. Columns are distributed evenly along the center of the platform and measure 8'-7" from the platform edge. The platform width is approximately 19'-0" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the edge of the station's southern mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-

Track Layout

Tracks are tangent. Therefore, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges are original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would be required for the installation of both APG and PSD systems.

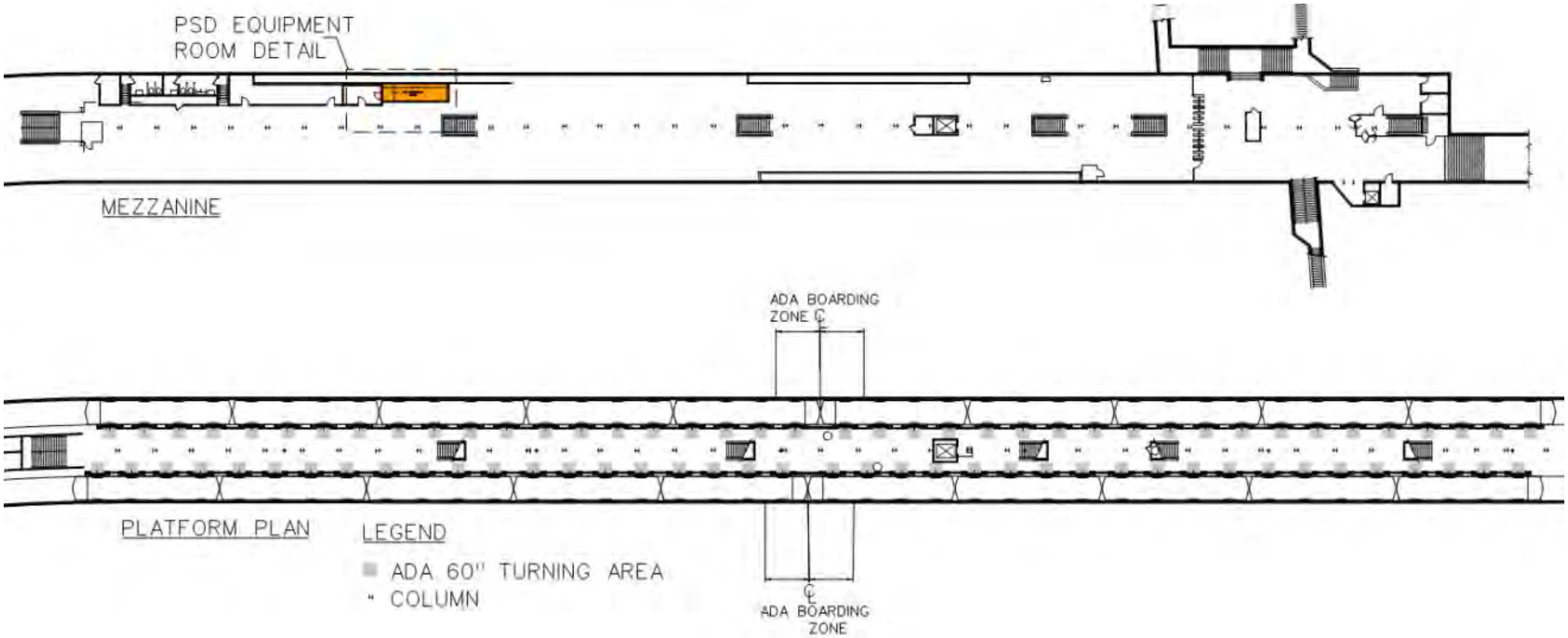

***Figure 1** – Overall Station Plan*
175th Street Station

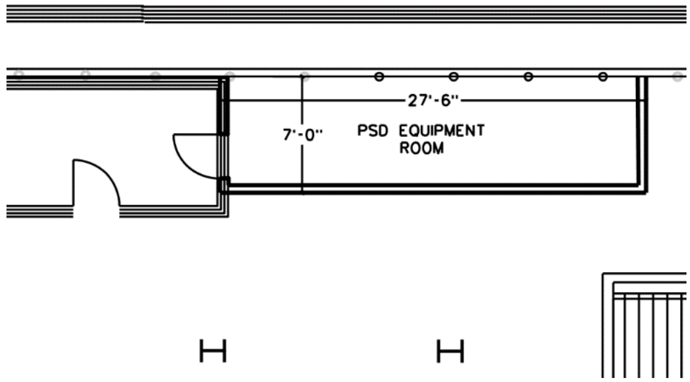

Figure 2 *– PSD Equipment Room Detail*
175th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal)

Station Name	175th Street
Peak Demand Load from ConEd Report, (kW)	75.2
Apparent Power (kVA)	94.0
Station Peak Demand Load, Max Current, (A)	261.1
Maximum Amount of Doors	80.0
PSD Total Load Including All Misc. Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	456
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	344
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis (Normal Service)

Station Power Capacity Analysis (Reserve)

Station Name	175th Street
Peak Demand Load from ConEd Report, (kW)	75.2
Apparent Power (kVA)	94.0
Station Peak Demand Load, Max Current, (A)	261.1
Maximum Amount of Doors	80.0
PSD Total Load Including All Misc. Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	456
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	344
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 2. Power Capacity Analysis (Reserve Service)

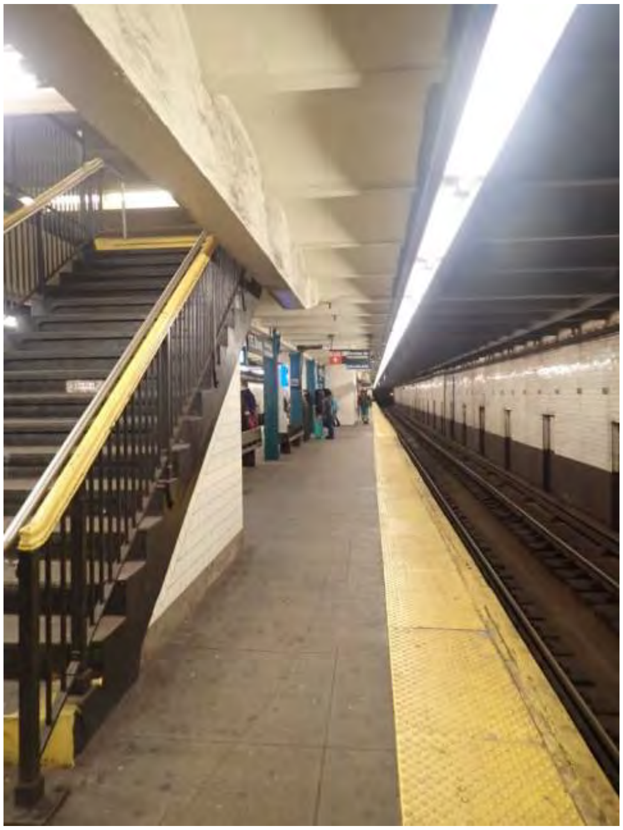

Figure 3 *– Typical platform view*
175th Street Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.9M to install APGs and $40.5M to install PSDs (See Appendix E).

1.06 – MR 148 | 168th Street Washington Heights

Summary: *168th Street Washington Heights Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the southbound platform as the existing width is 4'-4" (see figure 1).*

Description

168th Street Washington Heights Station is a below-grade station with two straight center / island platforms. The platform structures are cast-in-place concrete. The width of the platforms measures approximately 17'-4" throughout. The corridor width adjacent to the permanent "Car Equipment Cleaning Station "structure at the south end of the southbound platform shown in photo below, is 4'-4" in width. Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

***Figure 1** – Non-Compliant egress condition*
168th Street Station

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1.07 – MR 149 | 163rd Street

Summary: *163rd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 27" (see figure 1).*

Description

163rd Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The platform widths are approximately 11'-8" throughout. The platforms are straight with two rows of columns measuring approximately 3'-6" from the platform edges. At the platform staircases, the columns measure 3'-6" from the platform edge and 1'-10" from the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 42" to 27" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
163rd Street Station

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1.08 – MR 150 | 155th Street

Summary: *155th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

155th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The platform widths are approximately 11'-10" throughout. The platforms are straight with two rows of columns measuring approximately 3'-4" from the platform edges. At the platform staircases, the columns measure 3'-4" from the platform edge and 0'-10" from the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 40" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
155th Street Station

1.09 – MR 151 | 145th Street (upper level)

Summary: *145th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

145th Street Station is a below-grade station with two levels of center / island platforms. The upper level serves the "A / C" trains and the lower level serves the "B / D" trains. The lower level of this station is addressed in prior reports for the B and D service. The platform structures are cast-in-place concrete.

The width of the upper platforms is approximately 22'-0" throughout. At staircases PL9 and P11 the columns are 20" from the staircase, and 40" from the southbound local platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum pinch point requirement of 32". The remaining 25" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
145th Street

1.10 – MR 152 | 135th Street Station

***Summary:** 135th Street Station is feasible for both APGs and PSDs. There are two ceiling mounted signals located at the center of each platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of both APG and PSD systems (see Appendix B). Existing power is adequate.*

Description

The 135th Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are distributed evenly along the edges of the platform and measure 3’-4” from the platform edge. The platform width varies from approximately 7’-0” to 14’-8”. On each of the southbound and northbound platforms there is a ceiling mounted signal located above the platform edge, with a vertical clearance of at least 7’-6”. Ceiling heights measure no less than 7’-6” throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the southern control area at the end of the northbound platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27’-6” x 7’-0”.

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges appear to be original to the station construction. From our limited visual inspection and our knowledge of original station construction, structural work would be required for the installation of both APG and PSD systems.

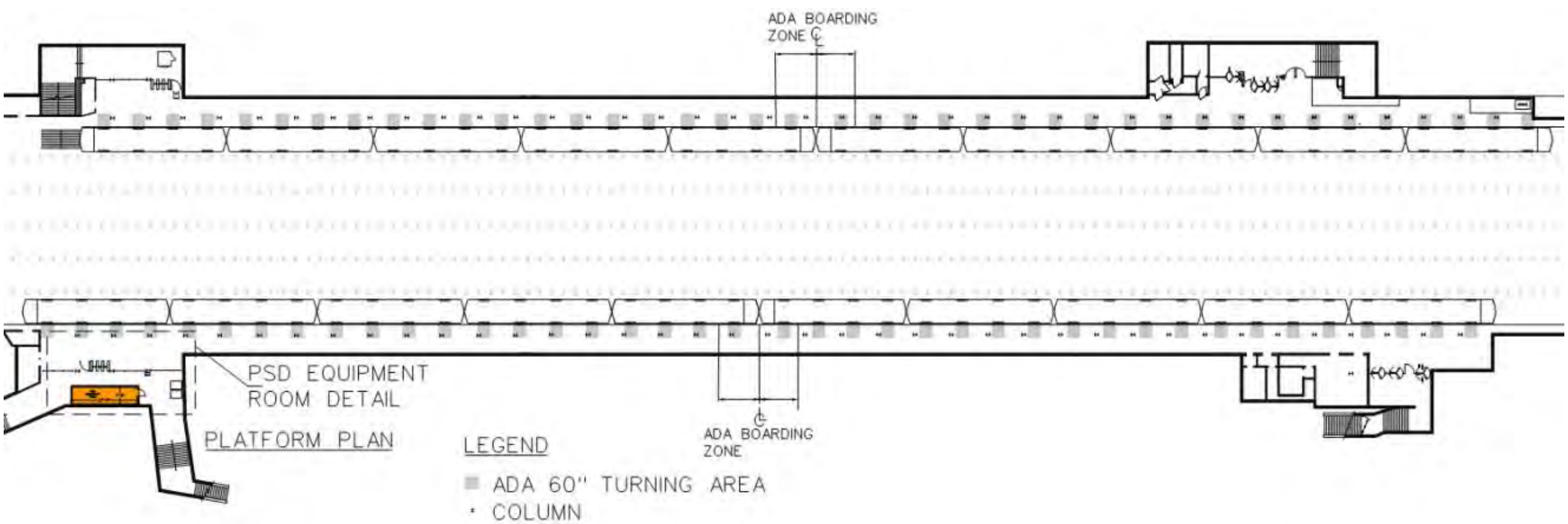

Figure 1 – *Overall Station Plan*
135th Street Station

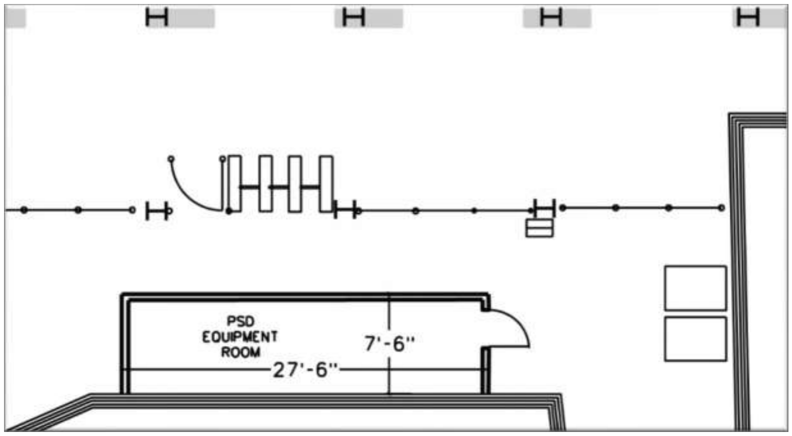

***Figure 2** – PSD Equipment Room 1 Detail*
135th Street Station

Platform obstructions within 5' of edge:
Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:
Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:
This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

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Station Power Capacity Analysis (Normal Service)

Station Name	135th Street
Peak Demand Load from ConEd Report, (kW)	55.2 (combined)
Apparent Power (kVA)	69.0
Station Peak Demand Load, Max Current, (A)	192.0
Maximum Amount of Doors	80
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	387
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	413
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis (Normal Service)

Station Power Capacity Analysis (Reserve Service)

Station Name	135th Street
Peak Demand Load from ConEd Report, (kW)	55.2 (combined)
Apparent Power (kVA)	69.0
Station Peak Demand Load, Max Current, (A)	192.0
Maximum Amount of Doors	80
PSD Total Load Including All Miscellaneous Loads, A)	194.6
Total Load (Station Peak + PSD), (A)	387
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	413
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 2. Power Capacity Analysis (Reserve Service)

Figure 3 *– Typical platform view*
135th Street Station

Historic Restrictions:
None.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions is listed in the attached ROM estimate. The total cost for this station is estimated to be $30.6M to install APGs and $39.4M to install PSDs (See Appendix E).

1.11 – MR 153 | 125th Street

Summary: *125th Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

125th Street St. Nicholas Ave. Station is a below-grade station with two center / island platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are distributed evenly along the center of each platform and measure 8'-4" from the platform edge. The platform widths vary from approximately 17'-4" to 17'-10". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

Since there are four platform edges, two equipment rooms are required. The equipment rooms can be located at the center of the station mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0" for each room.

Track Layout

Tracks are nearly tangent. Therefore, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

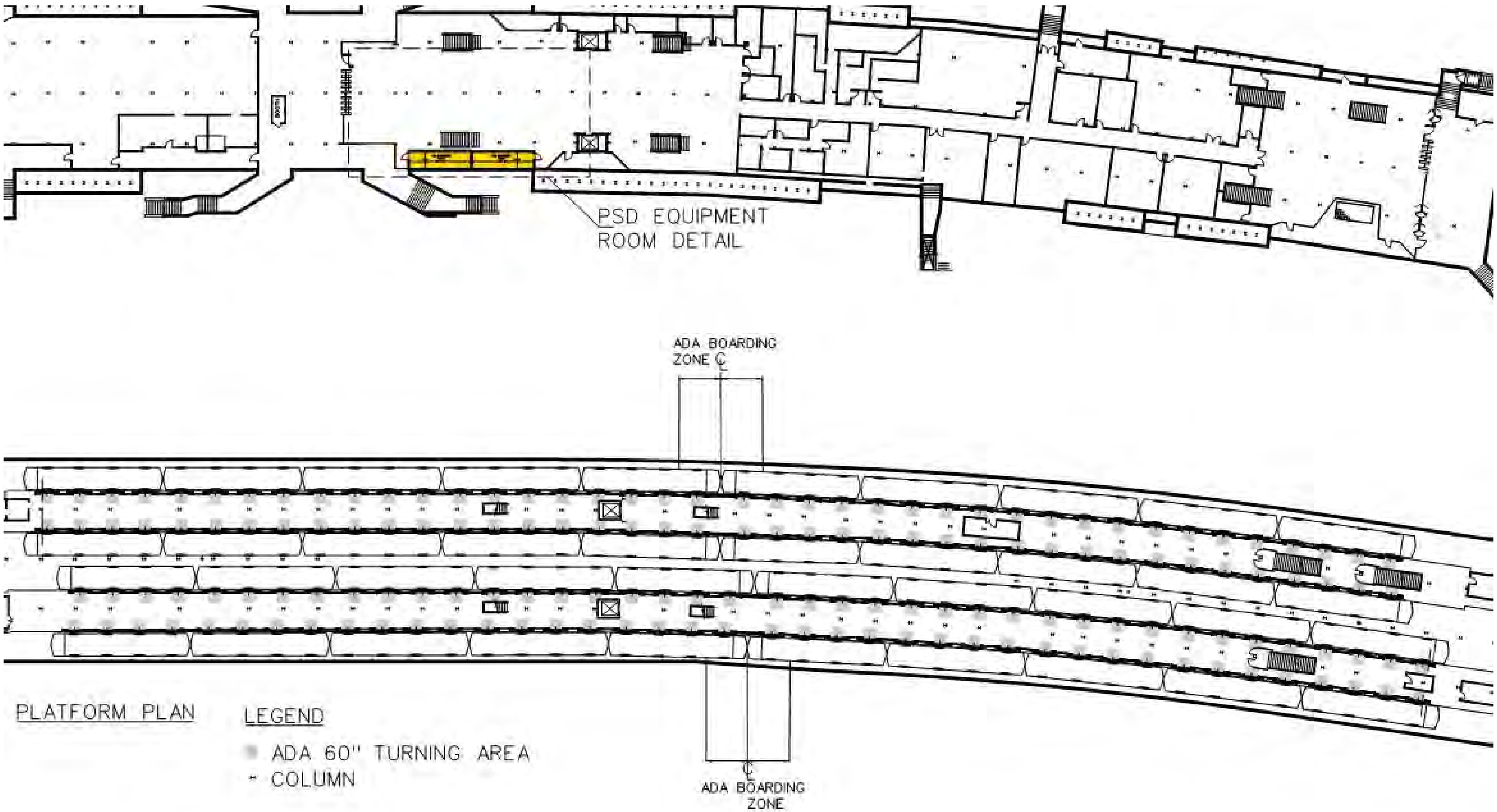

Figure 1 *– Overall Station Plan*
125th Street Station

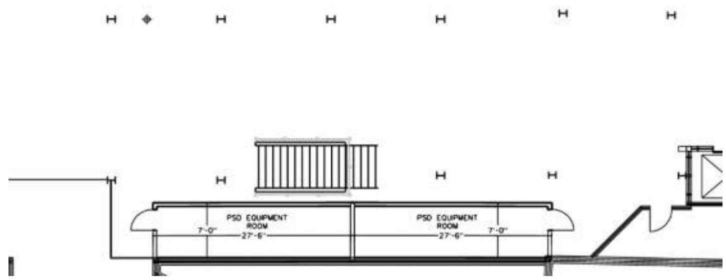

***Figure 2** – PSD Equipment Room Detail*
125th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	125th Street St. Nicholas Ave.
Peak Demand Load from ConEd Report, (kW)	245.6 (combined)
Apparent Power (kVA)	307.0
Station Peak Demand Load, Max Current, (A)	852.8
Maximum Amount of Doors	160
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	1193
Station Service Power Capacity,(A)	1200
Service Spare Capacity, (A)	7
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 1200A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis (Normal Service)

Station Power Capacity Analysis (Reserve Service)

Station Name	125th Street St. Nicholas Ave.
Peak Demand Load from ConEd Report, (kW)	245.6 (combined)
Apparent Power (kVA)	307.0
Station Peak Demand Load, Max Current, (A)	852.8
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads,(A)	340.6
Total Load (Station Peak + PSD), (A)	1193
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	7
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 1200A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve

Table 2. Power Capacity Analysis (Reserve Service)

***Figure 3** – Typical platform view*
125th Street Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The cost of installation for the A-train for this station is estimated to be $31.4M to install APGs and $40.7M to install PSDs. The cost of installation for the C-train for this station is estimated to be $31.4M to install APGs and $40.7M to install PSDs (See Appendix E).

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1.12 – MR 154 | 116th Street Station

Summary: *116th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 19" (see figure 1).*

Description

116th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms range from approximately 2'-10" to11'-8". The width at the south end of the northbound platform is 34". The implementation of a platform edge barrier would reduce this already noncompliant width below the required minimum corridor requirement of 36". The remaining 19" or less* would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – Non-Compliant ADA condition
116th Street Station

1.13 – MR 155 | 110th Street Station

Summary: *110th St. Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 21" (see figure 1).*

Description

110th St. Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-0' to 11'-8". The implementation of a platform edge barrier would reduce this lesser (already noncompliant) width below the required minimum corridor requirement of 36". The remaining 21" or less* would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

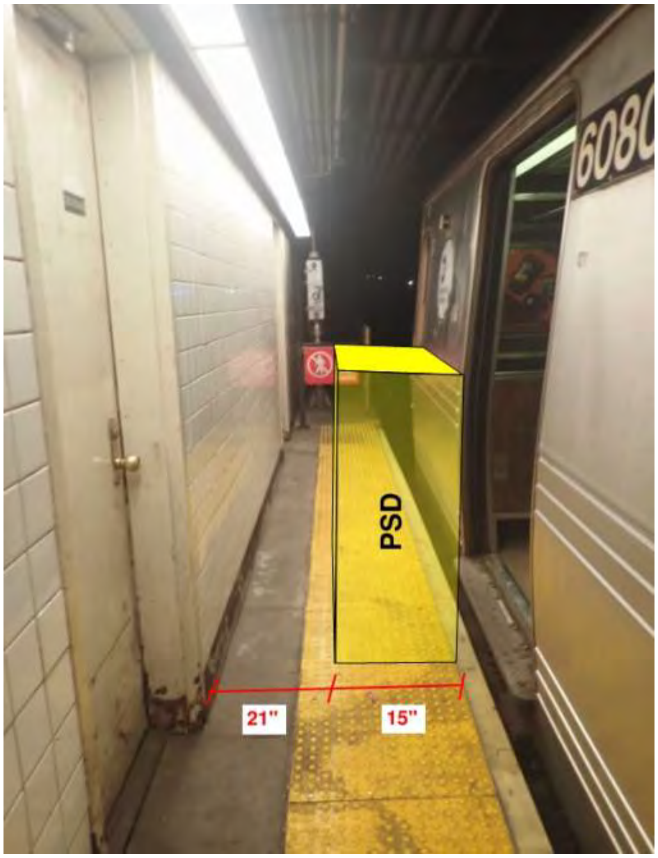

Figure 1 – Non-Compliant ADA condition
110th Street

1.14 – MR 156 | 103rd Street Station

Summary: *103rd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 13" (see figure 1).*

Description

103rd Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 2'-4' to 10'-0". The implementation of a platform edge barrier would reduce this lesser (already noncompliant) width, below the required minimum corridor requirement of 36". The remaining 13" or less* would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – Non-Compliant ADA condition
103rd Street

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1.15 – MR 157 | 96th Street Station

Summary: *96th Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG or PSD system (see Appendix B). Existing power is adequate.*

Description

The 96th Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are distributed evenly along each platform and measure 3'-4" from the platform edge. The platform widths vary from approximately 11'-8" to 12'-0". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the northern control area at the end of the northbound platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges appear to be original to the station construction. From our limited visual inspection and our knowledge of original station construction, structural work would at a minimum be required for the installation of an APG or a PSD system.

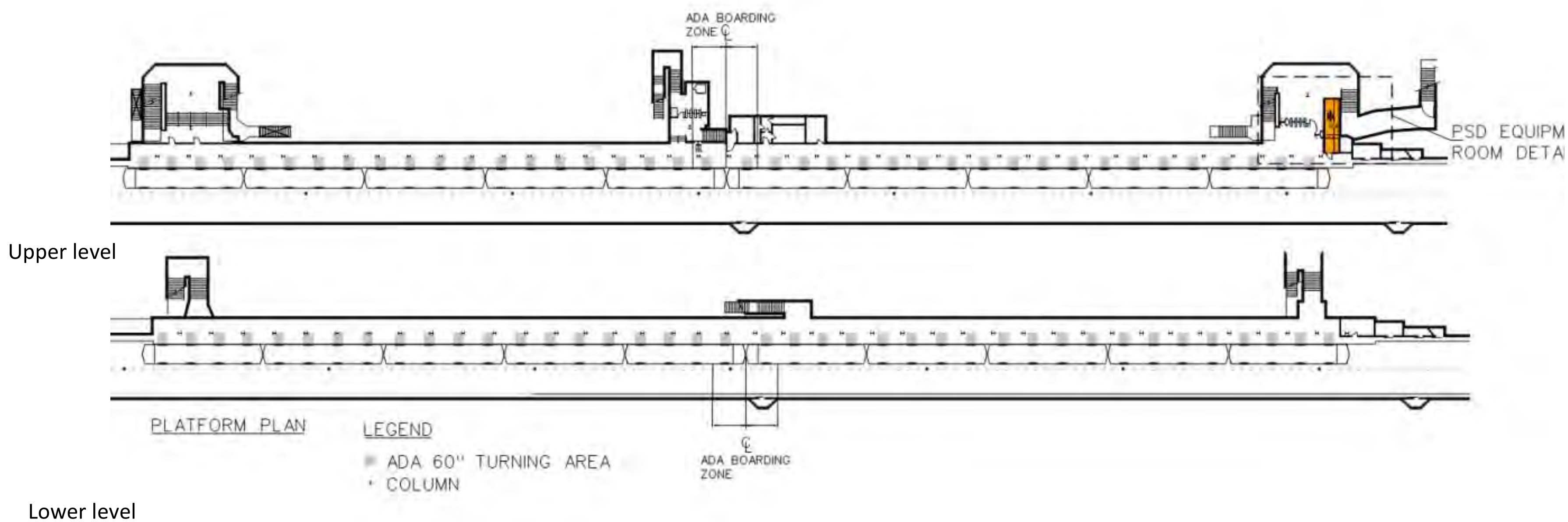

***Figure 1** – Overall plan*
96th Street Station

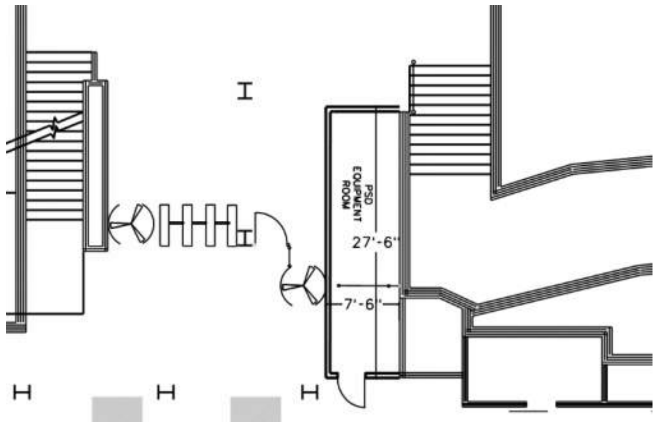

Figure 2 *– PSD Equipment Room Detail*
96th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of a APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	96th Street
Peak Demand Load from ConEd Report, (kW)	47.2 (combined)
Apparent Power (kVA)	59.0
Station Peak Demand Load, Max Current, (A)	163.9
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	358
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	442
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the field survey (photos) having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve. 1 line diagram provided does not have service rating and is incomplete.

Table 1. Power Capacity Analysis (Normal Service)

Station Power Capacity Analysis (Reserve Service)

Station Name	96th Street
Peak Demand Load from ConEd Report, (kW)	47.2 (combined)
Apparent Power (kVA)	59.0
Station Peak Demand Load, Max Current, (A)	163.9
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	358
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	442
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the field survey(photos) having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve. 1 line diagram provided does not have service rating and is incomplete.

Table 2. Power Capacity Analysis (Reserve Service)

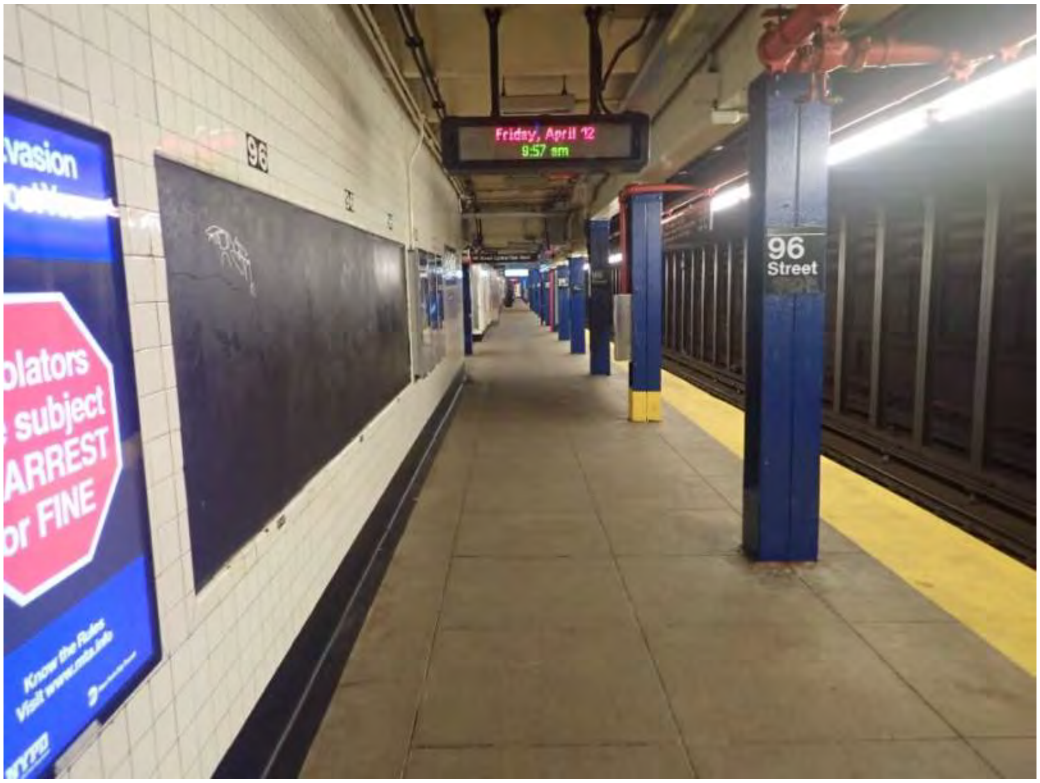

***Figure 3** – General platform view*
96th Street Station

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $30.8M to install APGs and $38.7M to install PSDs (See Appendix E).

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1.16 – MR 158 | 86th Street Station

Summary: *86th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 21" (see figure 1).*

Description

86th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-0' to 11'-8". The implementation of a platform edge barrier would reduce this lesser width below the required minimum corridor requirement of 36". The remaining 21" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
86th St Station

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1.17 – MR 159 | 81st Street Station

Summary: *81st St. Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

81st St. Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-4' to 11'-10". The implementation of a platform edge barrier would reduce this lesser width below the required minimum corridor requirement of 36". The remaining 25" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – Non-Compliant ADA condition
81st St. Station

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1.18 – MR 160 | 72nd Street Station

Summary *72nd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the north end of the southbound platform as the existing width is 4'-8" (see figure 1).*

Description

72nd Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 4'-8' to 11'-10". The north end of the southbound platform in the photo below, is 4'-8" in width. Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

Figure 1 – Non-Compliant ADA condition
72nd Street Station

1.19 – MR 161 | 59th Street Columbus Circle Station

Summary: *59th Street Columbus Circle Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32” minimum pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 21” (see figure 1).*

Description

59th Street Columbus Circle Station is a below-grade station consisting of two center / island platforms (there is a third island platform which is closed to the public). The platform widths vary from approximately 10’-8” – 29’-0”. The platforms are mildly curved with two rows of columns approximately 3’-4” from edge of platform. At the platform staircases, the columns measure 3’-0” from the platform edge and 2’-2” from the staircase (see figure 1 for reference).The implementation of a platform edge barrier would reduce the currently compliant width of 36” to 21” or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

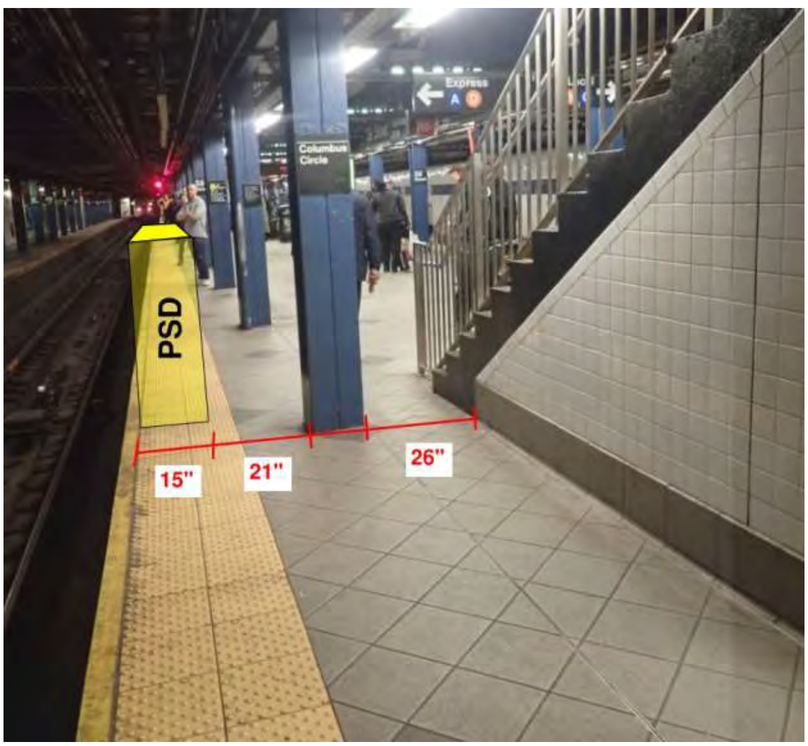

Figure 1 *–platform*
59th Street Columbus Circle Station

1.20 – MR 162 | 50th Street Station (Upper level)

Summary: *50th Street Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of both an APG and PSD system (see Appendix B). There are three ceiling mounted signals located at the platform edge which would require relocation to implement a full height PSD system. Existing power is adequate.*

Description

The 50th Street Station is a below-grade station with two levels of straight side platforms **(see Figure 1)**. The upper level services the 8th Avenue "A / C" line and the lower level services the Queens Boulevard "E" line. This report concerns the upper level only; the lower level of this station is addressed in the E-train report. The platform structures are cast-in-place concrete. Columns are distributed evenly along the edges of the platform and measure 3'-4" from the platform edge. The platform widths vary from approximately 7'-2" to 15'-8". Ceiling heights measure no less than 7'-6" throughout. There is one signal near the southbound platform edge at a height of 7'-6", and two signals at the northbound platform edge at 7'-6" above floor.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the northern closed control area at the end of the northbound platform (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges appear to be original to the station construction. From our limited visual inspection and our knowledge of original station construction, structural work would be required for both the installation of an APG and a PSD system.

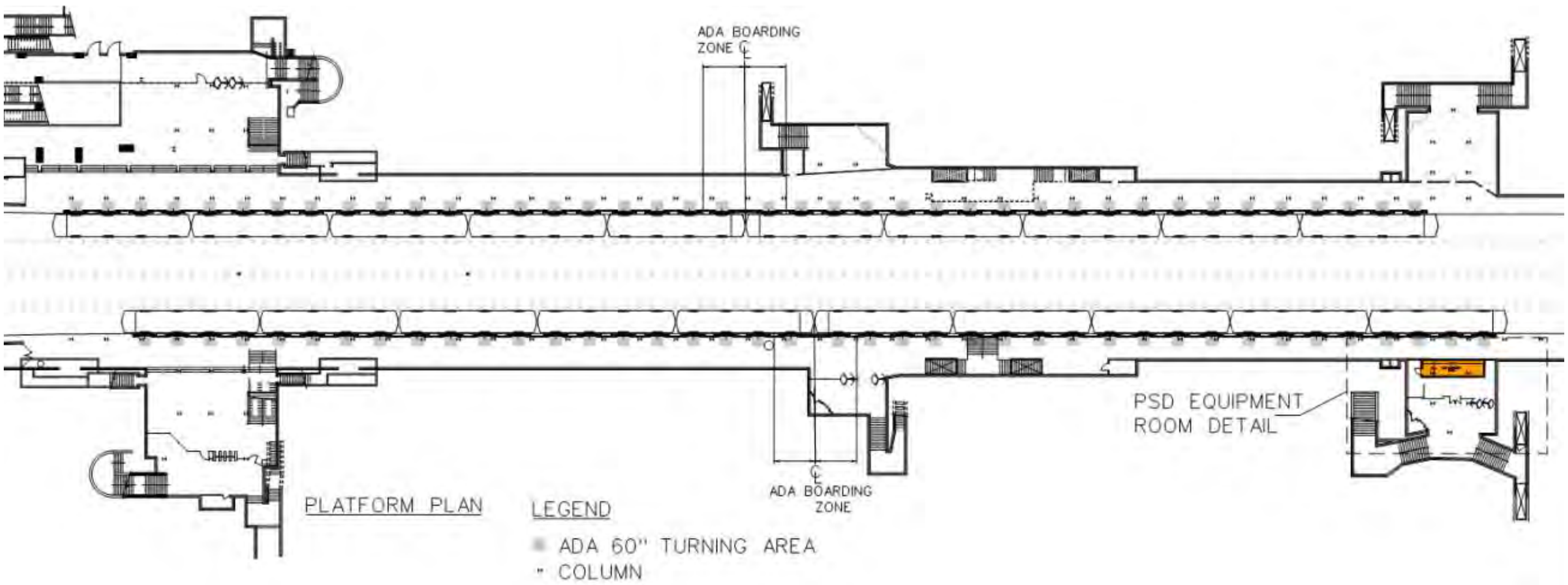

***Figure 1** – Overall Station Plan*
50th Street Station (Upper level)

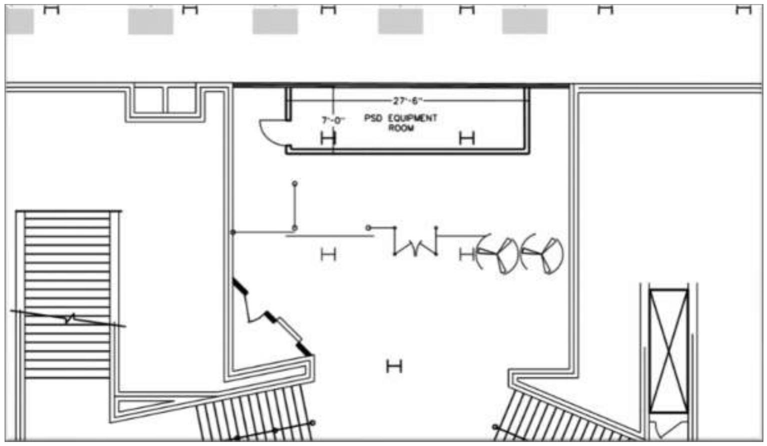

Figure 2 *– PSD Equipment Room at abandoned control area*
50th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal)

Station Name	50th Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	96.0
Apparent Power (kVA)	120.0
Station Peak Demand Load, Max Current, (A)	333.3
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	674
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	526
Is Electrical Service Adequate?	**Yes**
Notes	Analysis is based on 1 line diagram. The station has (2) separate meters with combined meter reading. (Services indicate 1200 A fuses at service switches)

Table 1. Power Capacity Analysis

Historic Restrictions:
None.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions is listed in the attached ROM estimate. The total cost for this station is estimated to be $32.0M to install APGs and $42.3M to install PSDs (See Appendix E).

Figure 3 *– Typical platform view*
50th Street Station (upper level)

1.21 – MR 163 | 42nd Street Port Authority Station

Summary: *42nd Street Port Authority Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at the ramp locations on both platforms. Wheelchair paths at the ramp locations would be constricted to less than 25".*

Description

42nd Street Port Authority Station is a below-grade station with two straight center / island platforms. The platform structures are cast-in-place concrete. The width of the southbound platform is approximately 35'-0" throughout tapering down to 16'-3" towards the northern end. The width of the northbound platform is approximately 29'-0" throughout tapering down to 24'-0" towards the southern end. There is one ramp along the southbound platform which would constrain wheelchair movement with PSDs installed. Columns are spaced 15' on center with column faces 3'-4" away from all platform edges. The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 25" or less* would not allow for ADA compliant wheelchair movement. **(see Figure 1)**.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains

Figure 1 – *Non-Compliant ADA condition at ramp 42nd Street Port Authority*

1.22-A – MR 164 | 34th Street Penn Station (A-Train Island Platform)

Summary: *34th Street Penn Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

34th Street Penn Station is a below-grade station with two straight side platforms servicing the "C&E" lines and a single center / island platform servicing the "A" line. The side platforms are addressed in the subchapter on the following page (1.22-C – MR 164 | 34th Street Penn Station (C-Train Side Platform).

The center / island platform structure is cast-in-place concrete. The platform width is approximately 23'-8" throughout. The platform is straight with two rows of columns measuring approximately 3'-4" from the platform edges. At the southern staircase, the columns measure 3'-4" from the platform edge and 0'-6" from the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 40" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
34th Street Penn Station

1.22-C – MR 164 | 34th Street Penn Station (C-Train Side Platform)

Summary: *34th Street Penn Station is feasible for both APGs and PSDs. There are two ceiling mounted signals located above the each platform edge which would require relocation to implement an APG or PSD system. Platform structural work would be required to support the requirements of an APG system (see Appendix B). Existing power is inadequate. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.*

Description

34th Street Penn Station is a below-grade station with two straight side platforms and one center/island platform **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 4'-0" from the platform edge. The southbound side platform width varies from approximately 11'-8" to 12'-0" throughout. The northbound side platform width is approximately 11'-6" throughout. On each platform there are two ceiling mounted monitors located above the platform edge, with a vertical clearance of at least 7'-4" **(see Figure 4)**. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Ceiling mounted monitors located above the platform edge would need to be relocated in the implementation of full height PSDs (see figure 3).

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the central station mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

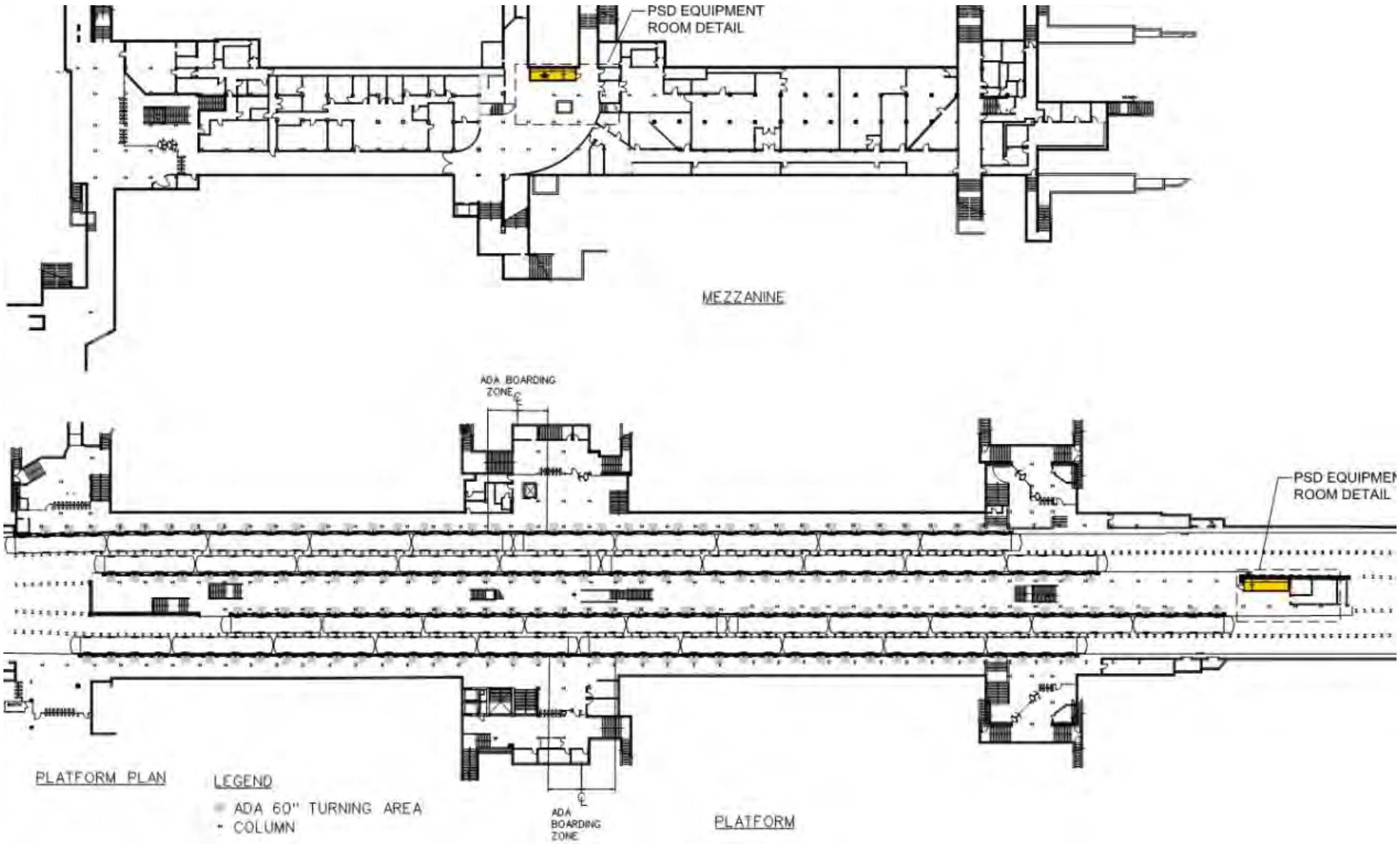

***Figure 1** – Overall Station Plan*
34th Street Penn Station

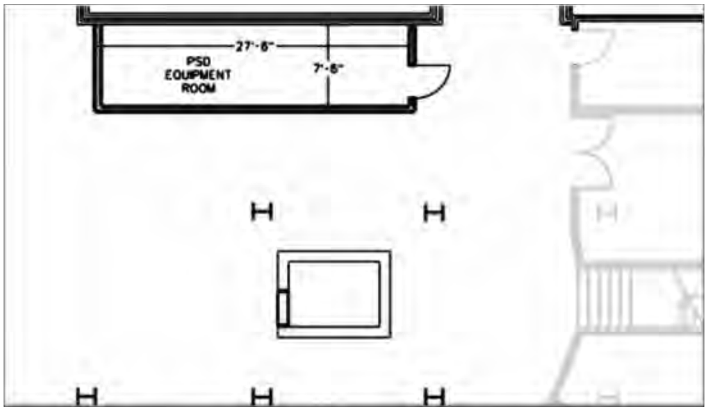

Figure 2 – *PSD Equipment Room Detail*

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has inadequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station

Station Power Capacity Analysis (Normal Service)

Station Name	34th Street Penn Station
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	293.6
Apparent Power (kVA)	367.0
Station Peak Demand Load, Max Current, (A)	1019.4
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	1360
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	0
Is Electrical Service Adequate?	**No**
Notes	Analysis is based on 1 line diagram. The station has (2) separate meters with combined meter reading. (Services indicate 800 A fuses at service switches)

Figure 3 *– Typical platform view (C-train platform)*
34th Street Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.0M to install APGs and $40.3M to install PSDs (See Appendix E)

1.23 – MR 165 | 23rd Street Station

Summary: *23rd Street Station is feasible for both APGs and PSDs. There is one ceiling mounted signal located at the north end of the southbound platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG or a PSD system (see structural report; Appendix B). Existing power is adequate.*

Description

23rd Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 3'-6" from the platform edge. The southbound side platform width varies from approximately 11'-10" to 17'-8". The northbound side platform width is also approximately 11'-6" to 17'-8". On the north end of the southbound platform there is one ceiling mounted signal located above the platform edge, with a vertical clearance of at least 7'-6" **(see Figure 3)**. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Ceiling mounted monitors located above the platform edge would need to be relocated in the implementation of full height PSDs (see figure 3).

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting..

Equipment Room

The equipment room could be located at the north end of the southbound platform, flush to the wall (**see Figure 1, Figure 2)**. The proposed room dimension is 27'-0" x 6-6".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges appear to be original to the station construction. From our limited visual inspection and our knowledge of original station construction, structural work would be required for the installation of both an APG and a PSD system.

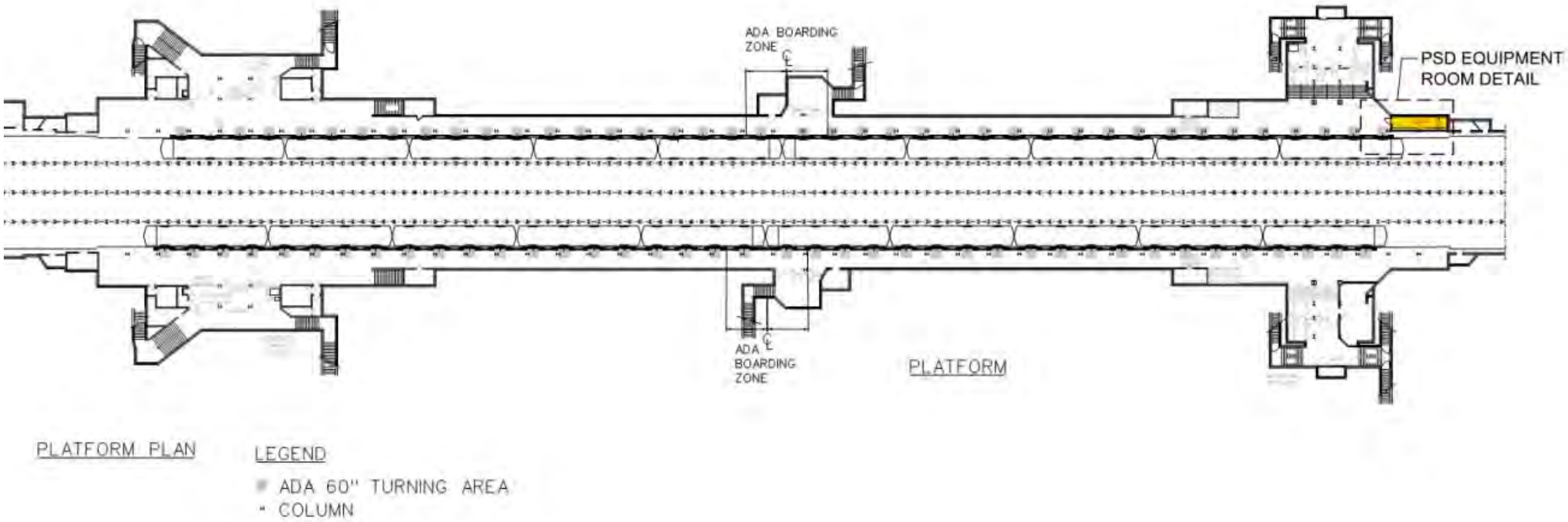

***Figure 1** – Overall Station Plan*
23rd Street Station

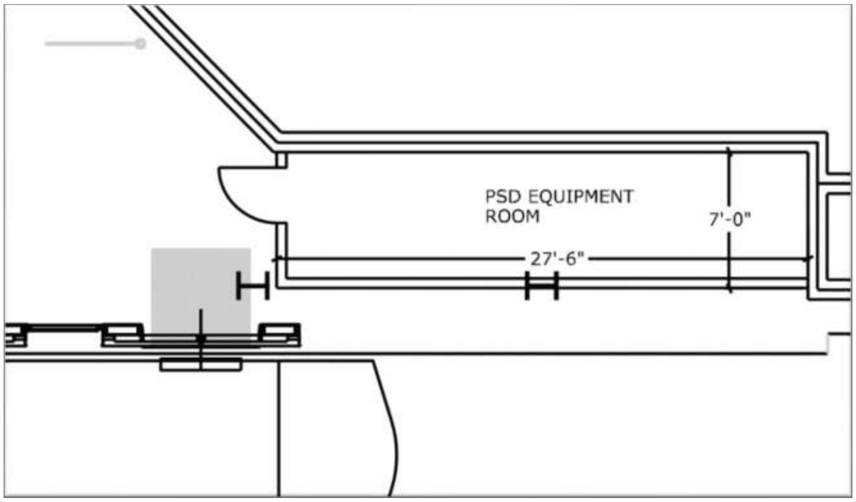

Figure 2 *– PSD Equipment Room 1 Detail*
23rd Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:
This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal)

Station Name	23rd Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	55.2
Apparent Power (kVA)	69.0
Station Peak Demand Load, Max Current, (A)	191.6
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	388
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	414
Is Electrical Service Adequate?	**Yes**
Notes	Analysis is based on 1 line diagram. The station has (2) separate meters with combined meter reading. (Services indicate 800 A fuses at service switches)

Table 1- *Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.0M to install APGs and $40.8M to install PSDs (See Appendix E)

***Figure 3** – Typical platform view with signal light*
23rd Street Station

1.24 – MR 166 | 14th Street -Eighth Avenue Station

Summary: *14th Street Station is feasible for both APGs and PSDs. The A line utilizes the inner edges of the two center / island platforms. The C and E lines utilize the outer edges. There are two ceiling mounted signals located on each platform which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is not adequate. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.*

Description

14th Street Station is a below-grade station with two straight center / island platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 10'-9" from the platform edge. The southbound platform width varies from approximately 21'-4" to 22'-4". The northbound platform width also varies from approximately 21'-4" to 22'-4". On both platforms there are two ceiling mounted signals located above the platform edge, with a vertical clearance of at least 7'-4". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, standard NYCT wayfinding signage, and ceiling mounted monitors. A signal light will need to be re-positioned to facilitate installation of a full-height system.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting..

Equipment Room

Since there are 4 platform edges at this station, 2 full size equipment rooms would be required. The equipment rooms could be located at the south end of the mezzanine, adjacent to staircase P18 (**see Figure 1, Figure 2 & Figure 3)**. The proposed room dimensions are 27'-0" x 6'-6" each.

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edge was reconstructed in the 1990's. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, reconstruction of the concrete platform edge work would at a minimum be required for the installation of an APG system.

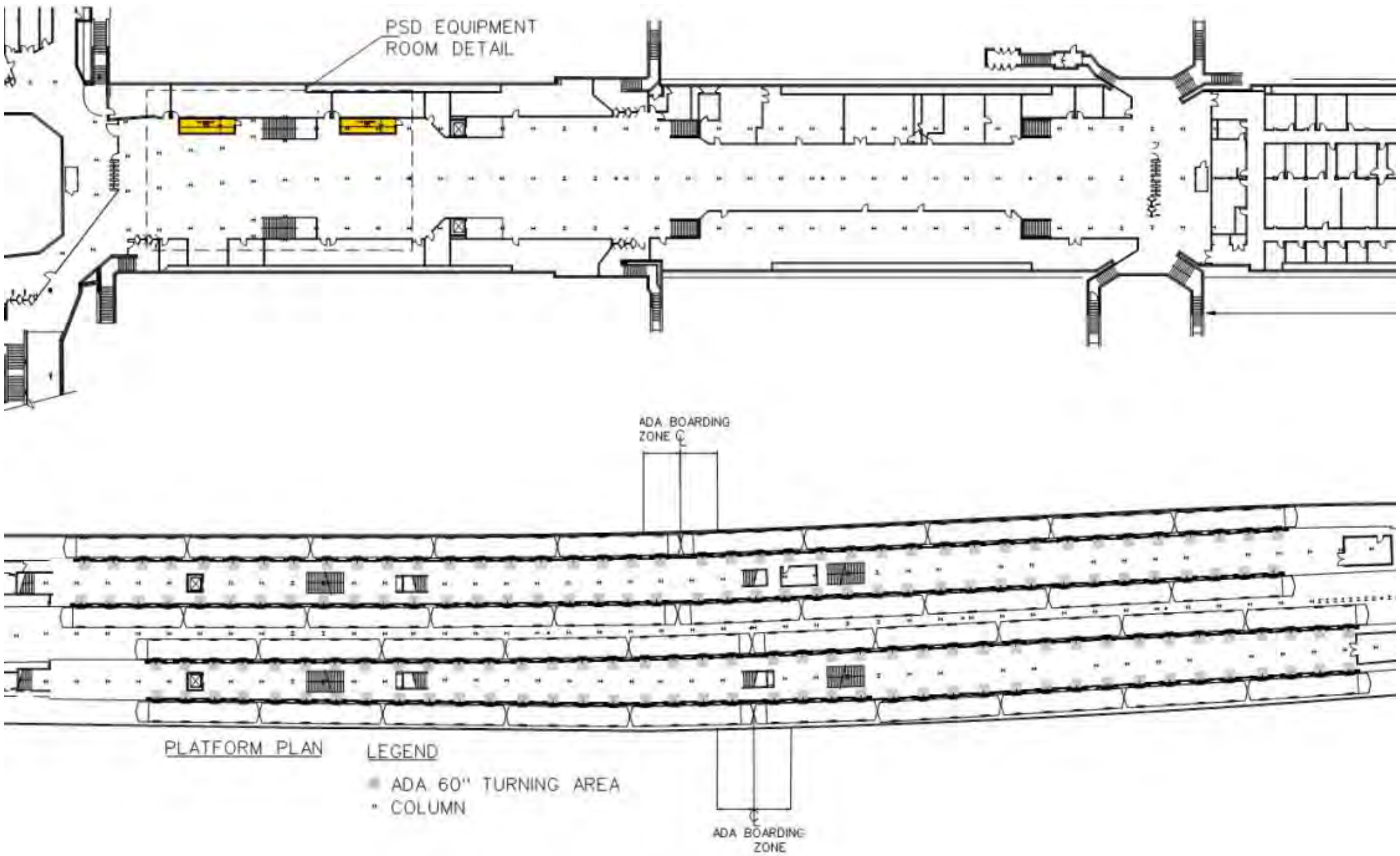

***Figure 1** – Overall Station Plan*
14th Street – Eighth AvenueStation

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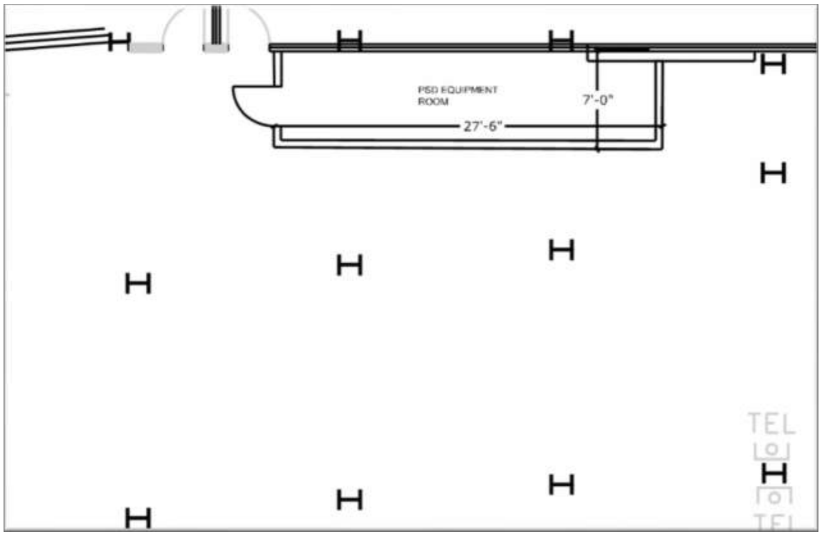

Figure 2 *– PSD Equipment Room 1 Detail*
14th Street Station

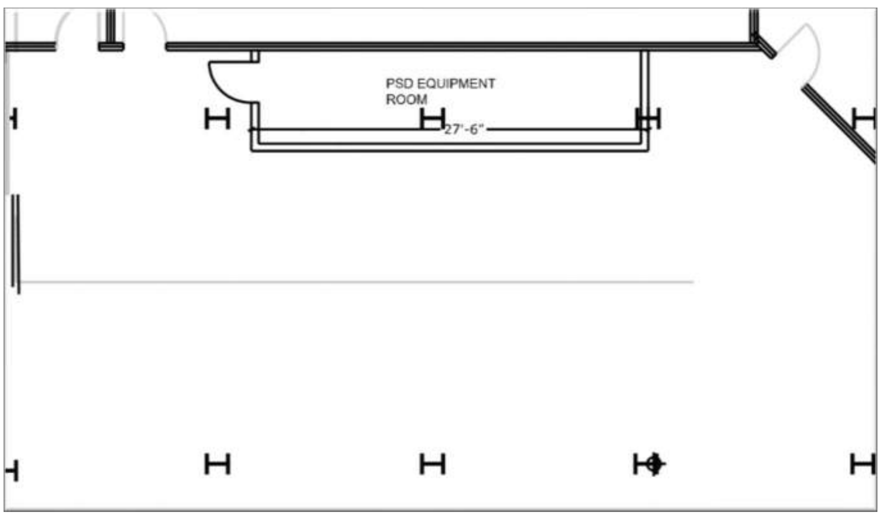

Figure 3 *– PSD Equipment Room 2 Detail*
14th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has inadequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	14th Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	339.2
Apparent Power (kVA)	424.0
Station Peak Demand Load, Max Current, (A)	1177.8
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	1518
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	0
Is Electrical Service Adequate?	NO
Notes	Analysis is based on 1 line diagram. The station has (2) separate meters with combined meter reading. (Service was upgraded from 800 A to 1200A)

***Table 1:** Power Capacity Analysis*

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The cost of installation for the A-train for this station is estimated to be $32.3M to install APGs and $41.8M to install PSDs. The cost of installation for the C-train for this station is estimated to be $32.3M to install APGs and $41.4M to install PSDs (See Appendix E).

***Figure 4** – Typical platform view with signal light*
14th Street Station

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1.25 – MR 167 | West 4th Street Station

Summary: *West 4th Street Station is feasible for both APGs and PSDs. Note that only the upper 8th Avenue platforms were evaluated for this report; the lower 6th Avenue platforms were evaluated in separate reports for the B, D, F, M, train services.*
There are two ceiling mounted signals located at the northbound platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG or a PSD system (see Appendix B). Existing power is not adequate. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Description

West 4th Street Station is a below-grade station with two levels of center / island platforms **(see Figure 1)**. This report covers only the upper level platforms which serve the A & C lines (and the E line covered in a separate report). The lower level platforms serving the B,D,F,M lines were found to be infeasible due to misalignment of train car doors.

The upper level platform structures are cast-in-place concrete. The platform columns are spaced 15’-0” on center, and column faces typically measure 3’-4” from platform edge. The northbound platform width measures approximately 25’-6” throughout. The southbound platform width measures approximately 27-2” throughout. On the southbound platform there are two ceiling mounted signals located above the platform edge, measuring no less than 7’-4” above the ground the **(see Figure 4)**. Ceiling heights measure no less than 7’-6” throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting..

Equipment Room

Since there are 4 platform edges at the upper level of this station, 2 full size equipment rooms would be required. The equipment rooms could be located in the mezzanine (**see Figure 1, Figure 2 & Figure 3).** The proposed room dimensions are 27’-0” x 6’-6” each.

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

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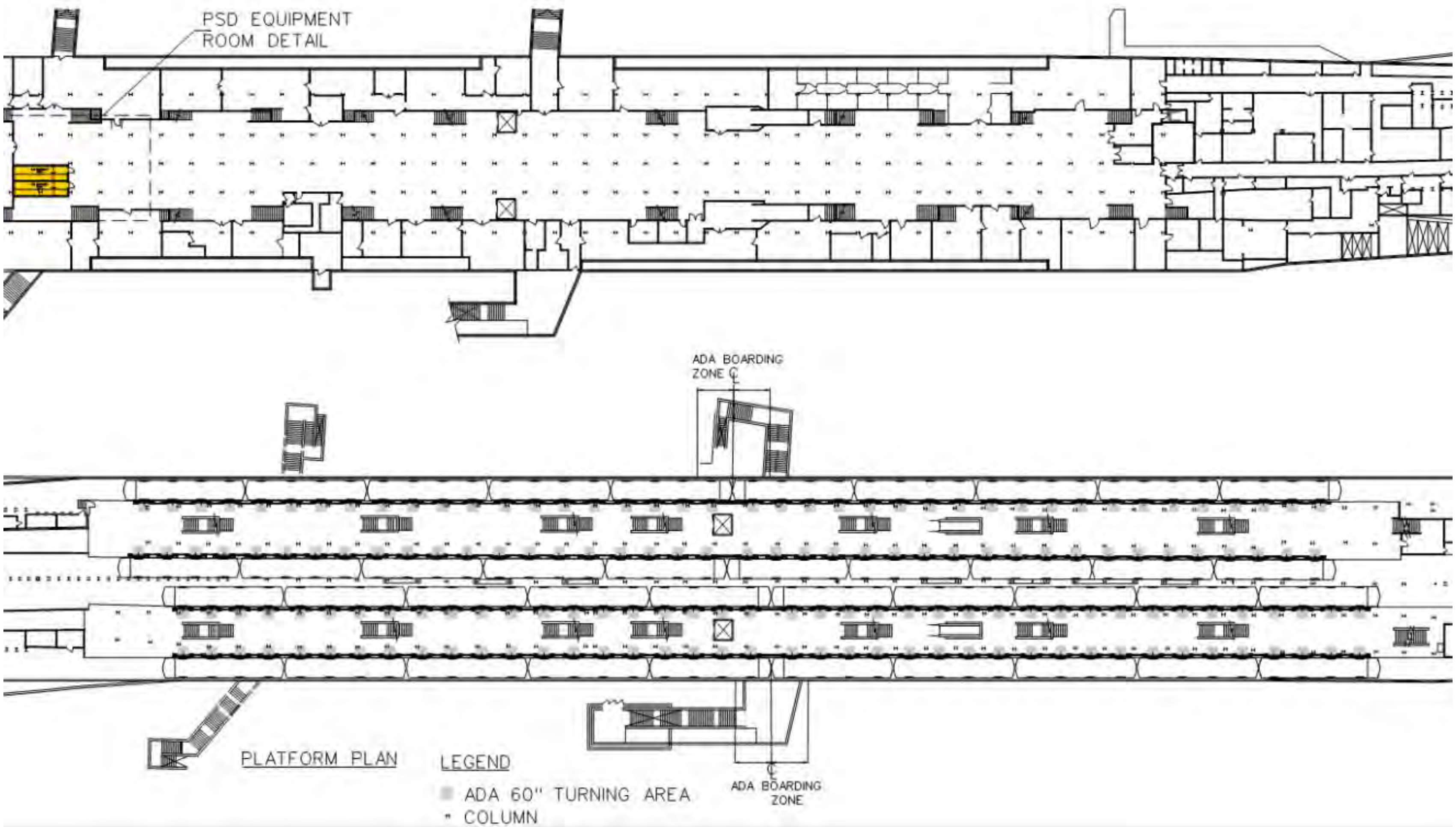

***Figure 1** – Overall Station Plan*
West 4th Street Station

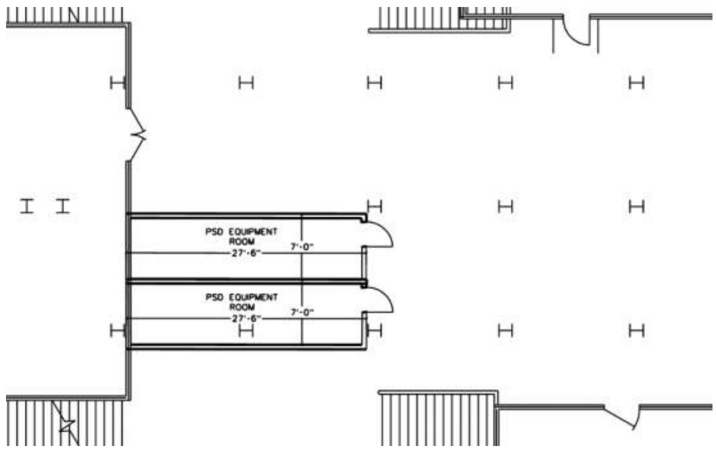

***Figure 2** – Equipment Room Plan*
West 4th Street Station

Platform Edge Condition

The platform edges appear to be original to the station construction. From our limited visual inspection and our knowledge of original station construction, structural work would be required for both the installation of an APG and a PSD system

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station does not have adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal)

Station Name	West 4th St.
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	292.0
Apparent Power (kVA)	365.0
Station Peak Demand Load, Max Current, (A)	1013.9
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	1354
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	0
Is Electrical Service Adequate?	**No**
Notes	Analysis is based on 1 line diagram. The station has (2) separate meters with combined meter reading. (Services indicate 1200 A fuses at service switches)

***Table 1**- Power Capacity Analysis*

Historic Restrictions:
West 4th Street Station is a historically designated property. As such, design will require review by the New York State Historical Preservation Office.

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The cost of installation for the A-train for this station is estimated to be $32.4M to install APGs and $41.0M to install PSDs. The cost of installation for the C-train for this station is estimated to be $32.4M to install APGs and $41.0M to install PSDs (See Appendix E).

***Figure 4** – Typical platform view with signal light*
West 4th Street Station

1.26 – MR 168 | Spring Street Station

Summary: *Spring Street Station is feasible for both APGs and PSDs. There is one ceiling mounted signal located at each platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG or a PSD system (see structural report; Appendix B). Existing power is adequate.*

Description

Spring Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 3'-6" from the platform edge. The southbound side platform width varies from approximately 11'-8" to 17'-8". The northbound side platform width varies from 11'-8" to 17'-0". On both platforms there is one ceiling mounted signal located above the platform edge, with a vertical clearance of at least 7'-5" **(see Figure 3)**. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Ceiling mounted signals located above the platform edge would need to be relocated in the implementation of full height PSDs **(see Figure 3).**

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting..

Equipment Room

The equipment room could be located at the north end of the northbound platform, flush to the wall adjacent to staircase P14 (**see Figure 1, Figure 2)**. The proposed room dimension is 27'-0" x 6-6".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges appear to be original to the station construction. From our limited visual inspection and our knowledge of original station construction, structural work would be required for the installation of both an APG and a PSD system.

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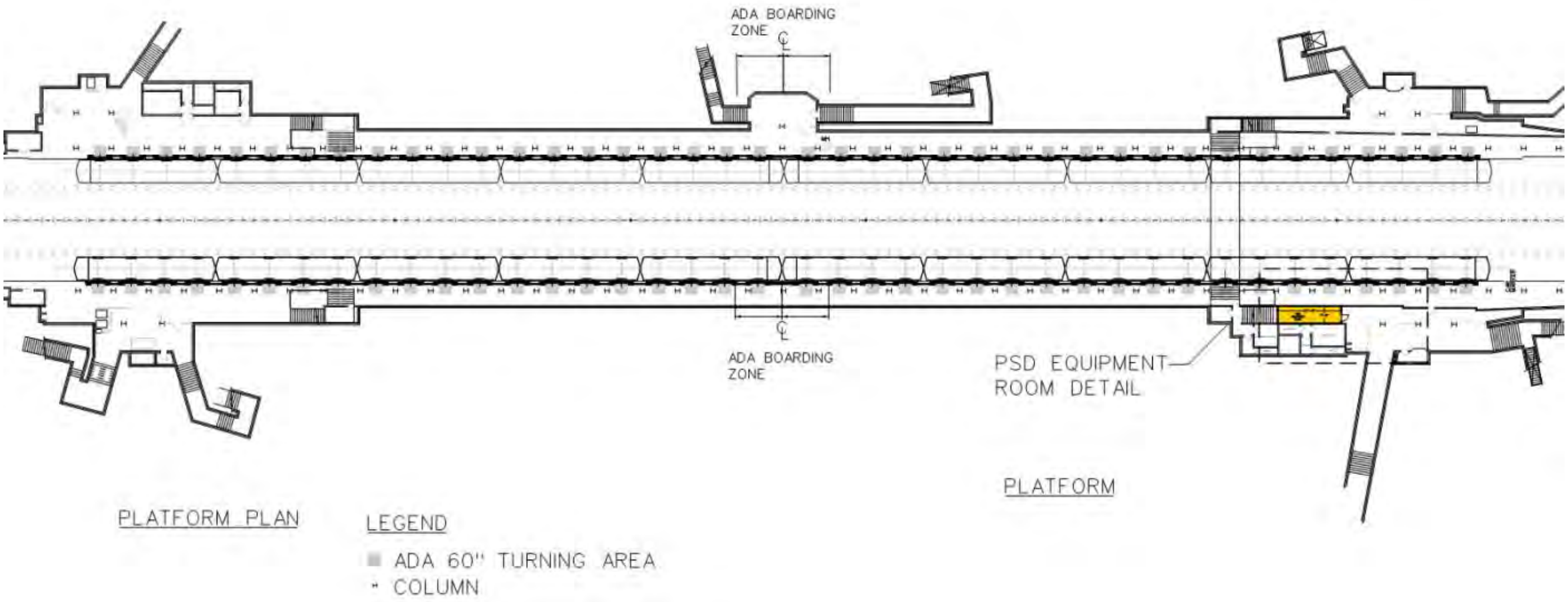

***Figure 1** – Overall Station Plan*
Spring Street Station

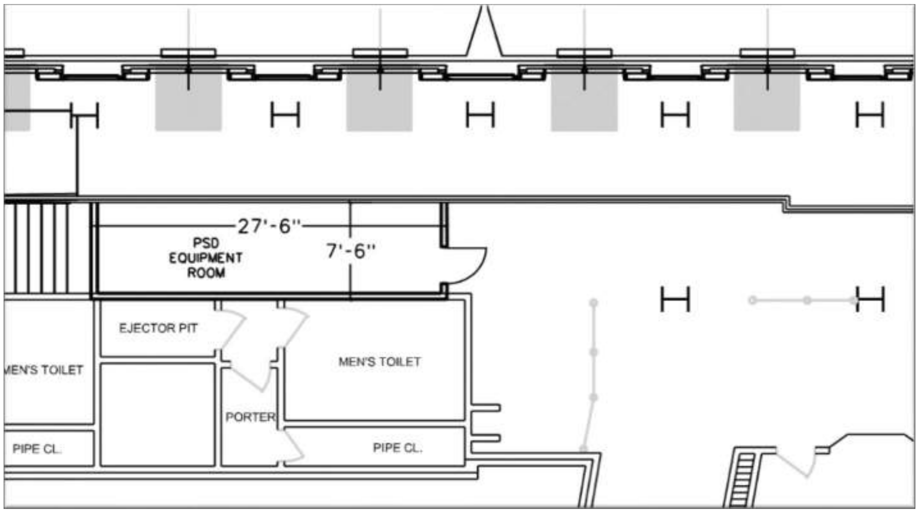

***Figure 2** – PSD Equipment Room 1 Detail*
Spring Street Station

Platform obstructions within 5' of edge:
Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions.

Lighting:
Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:
This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal)

Station Name	Spring Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	80.4
Apparent Power (kVA)	100.5
Station Peak Demand Load, Max Current, (A)	279.2
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	474
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	726
Is Electrical Service Adequate?	**Yes**
Notes	Analysis is based on 1 line diagram. The station has (2) separate meters with combined meter reading.

***Table 1**- Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.1M to install APGs and $41.6M to install PSDs (See Appendix E)

***Figure 3** – Typical platform view with signal light*
Spring Street Station

1.27 – MR 169 | Canal Street Station

Summary: *Canal Street Station is feasible for both APGs and PSDs. There are three ceiling mounted signals located on each platform which would require relocation to implement a full height PSD system. Platform structural work would be required to support the requirements of an APG system (see structural report; Appendix B). Existing power is adequate.*

Description

Canal Street Station is a below-grade station with two straight center/island platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are spaced 15’-0” on center with column faces approximately 10’-6” from the platform edge. The southbound platform width varies from approximately 15’-6” to 22’-4”. The northbound platform width varies from approximately 19’’-6” to 22’-2”. On both platforms there are three ceiling mounted signals located above the platform edge, with a vertical clearance of at least 7’-1” **(see Figure 4)**. Ceiling heights measure no less than 7’-6” throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting..

Equipment Room

Since there are 4 platform edges at this station, 2 full size equipment rooms would be required. The equipment rooms could be located at the center of the mezzanine, flush to one of the walls of the mezzanine (**see Figure 1, Figure 2 & Figure 3)**. The proposed room dimensions are 27’-0” x 6’-6” each.

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed in the 1990s. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, reconstruction of the concrete platform edge will be required at a minimum for the installation of an APG system.

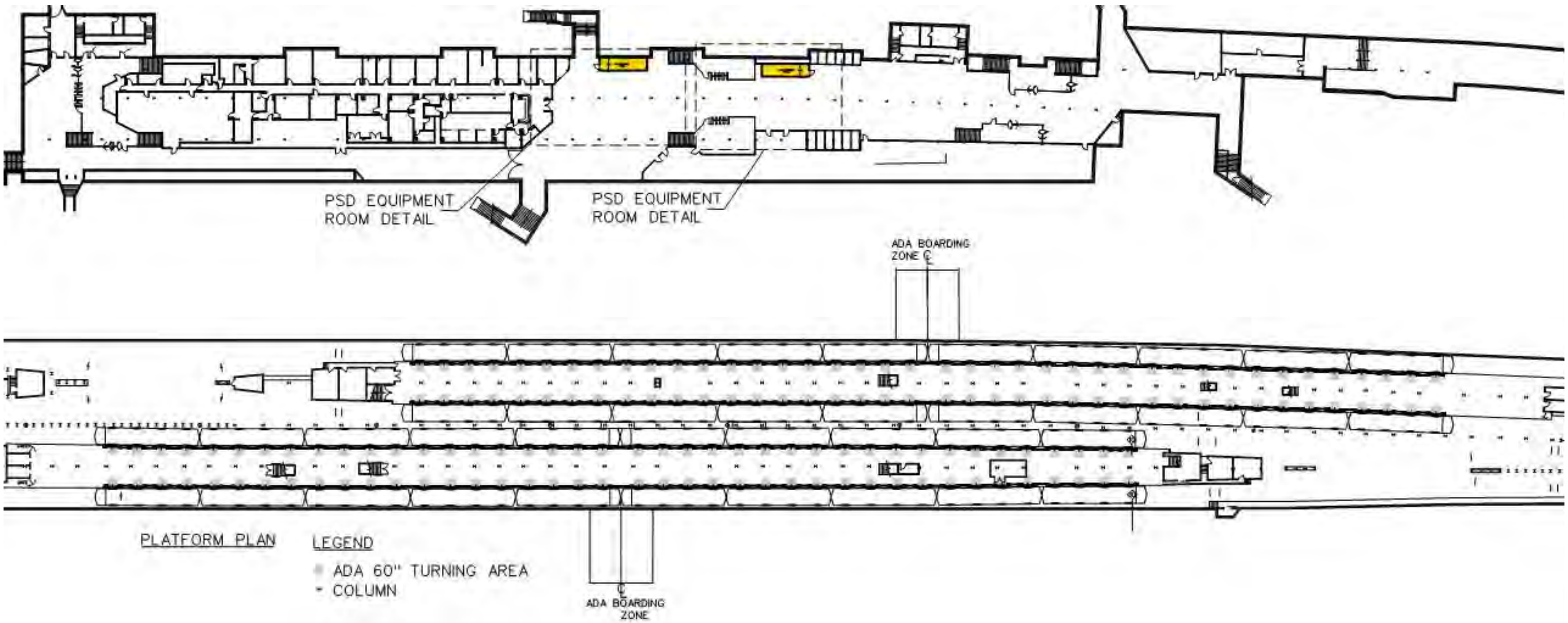

__Figure 1__ – Overall Station Plan
Canal Street Station

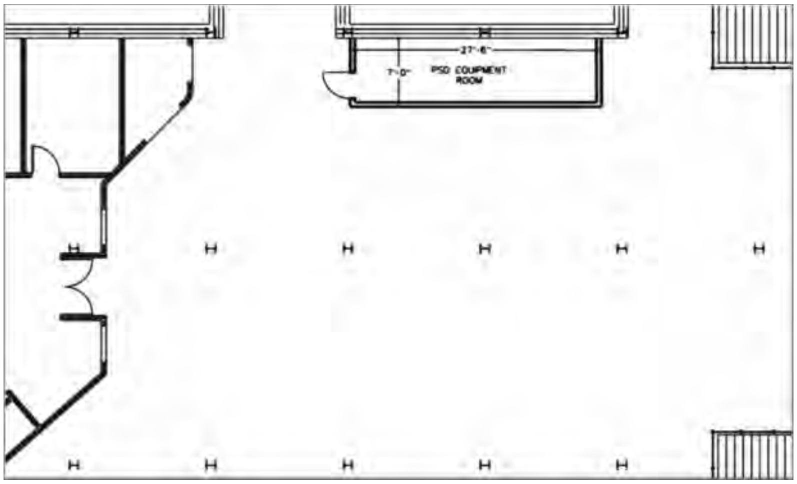

Figure 2 *– PSD Equipment Room 1 Detail*
Canal Street Station

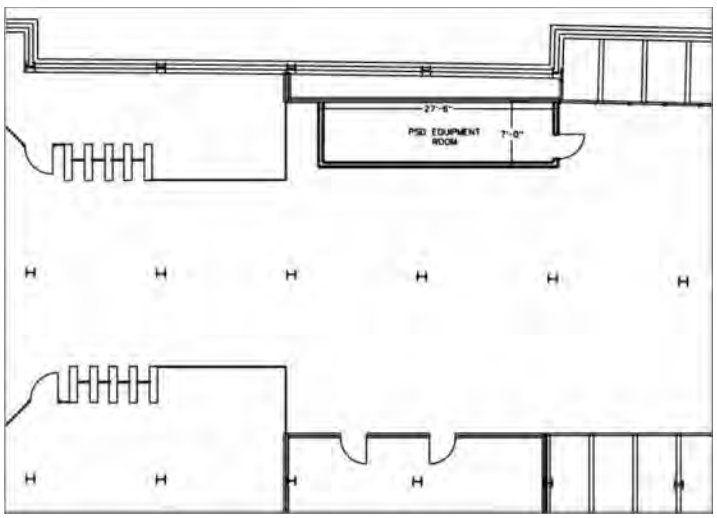

Figure 3 *– PSD Equipment Room 2 Detail*
Canal Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: Throughout both platforms; linear florescent; perpendicular to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Reserve)

Station Name	Canal Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	90.4
Apparent Power (kVA)	113.0
Station Peak Demand Load, Max Current, (A)	313.9
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.8
Total Load (Station Peak + PSD), (A)	655
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	145
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram. Station has (2) separate meter reading, for each Normal & Reserve service.

***Table 1**- Power Capacity Analysis*

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The cost of installation for the A-train for this station is estimated to be $31.9M to install APGs and $42.6M to install PSDs. The cost of installation for the C-train for this station is estimated to be $31.9M to install APGs and $42.6M to install PSDs (See Appendix E).

***Figure 4** – Typical platform view with signal light*
Canal Street Station

1.28 – MR 170 | Chambers Street Station

Summary: *Chambers Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

Chambers Street Station is a below-grade station consisting of one center / island platform. The platform width varies from approximately 15'-0" to 25'-4". The platform is mildly curved with two rows of columns approximately 3'-6" from edges of platform. At the platform staircases, the columns measure 3'-4" from the platform edge and are flush to the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 40" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-compliant ADA dimension*
Chambers Street Station

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1.29 – MR 172 | Fulton Street Station

Summary: *| Fulton Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Fulton Street Station is a below-grade station with one center / island platform (**see Figure 1)**. The platform structure is cast-in-place concrete. Columns are distributed evenly along the platform and measure 2'-8" from the platform edge. The platform widths measure approximately 22'-0" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the center of the station mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'A' & 'C' Line Stations
(Fulton Street Station)

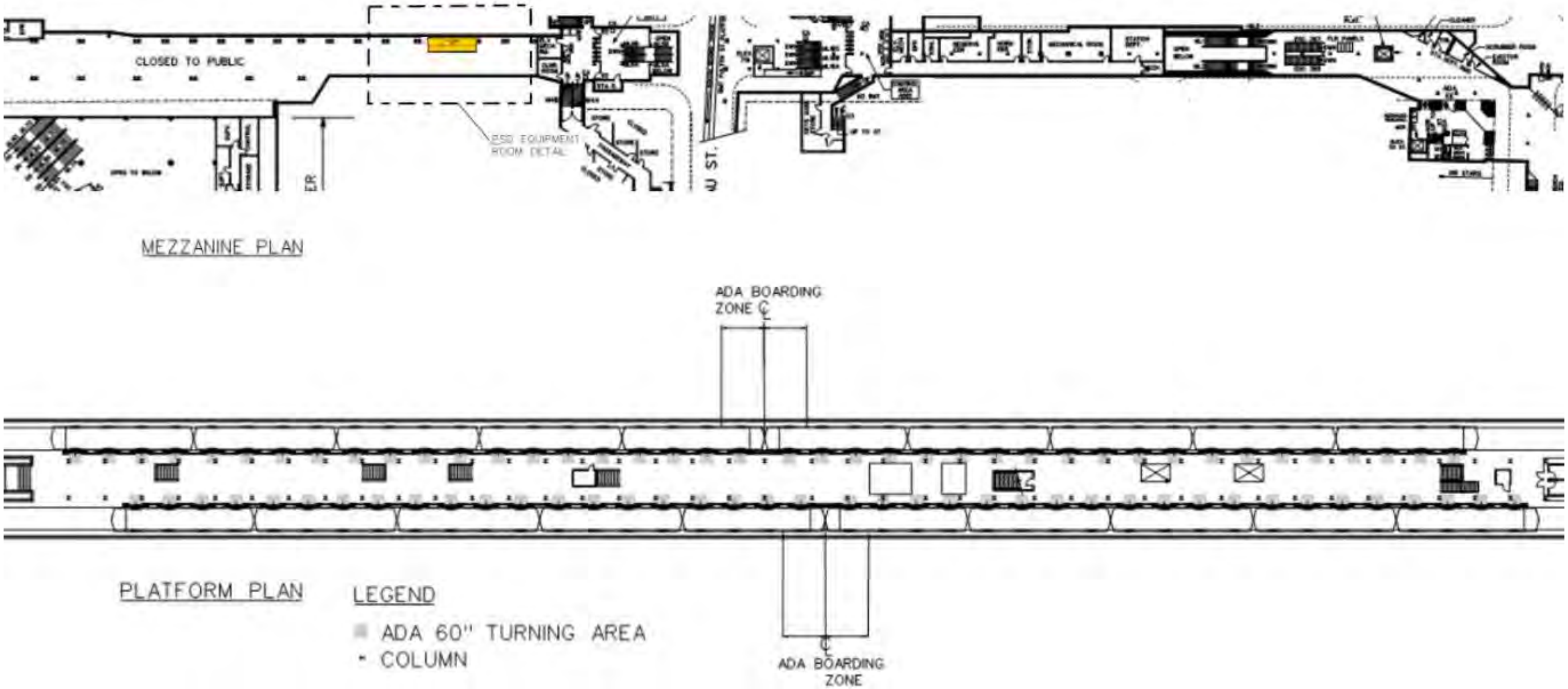

Figure 1 – Overall Station Plan
Fulton Street Station

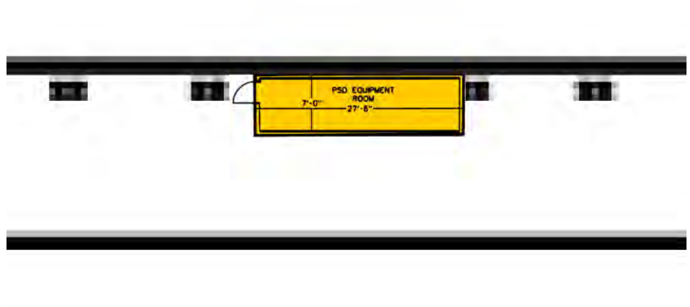

***Figure 2** – PSD Equipment Room Detail*
Fulton Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal)

Station Name	Fulton St.
Peak Demand Load from ConEd Report, (kW)	153.2
Apparent Power (kVA)	191.5
Station Peak Demand Load, Max Current, (A)	531.9
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	727
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	473
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 1200A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve)

Station Name	Fulton St.
Peak Demand Load from ConEd Report, (kW)	153.2
Apparent Power (kVA)	191.5
Station Peak Demand Load, Max Current, (A)	531.9
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	727
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	473
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 1200A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 2. Power Capacity Analysis

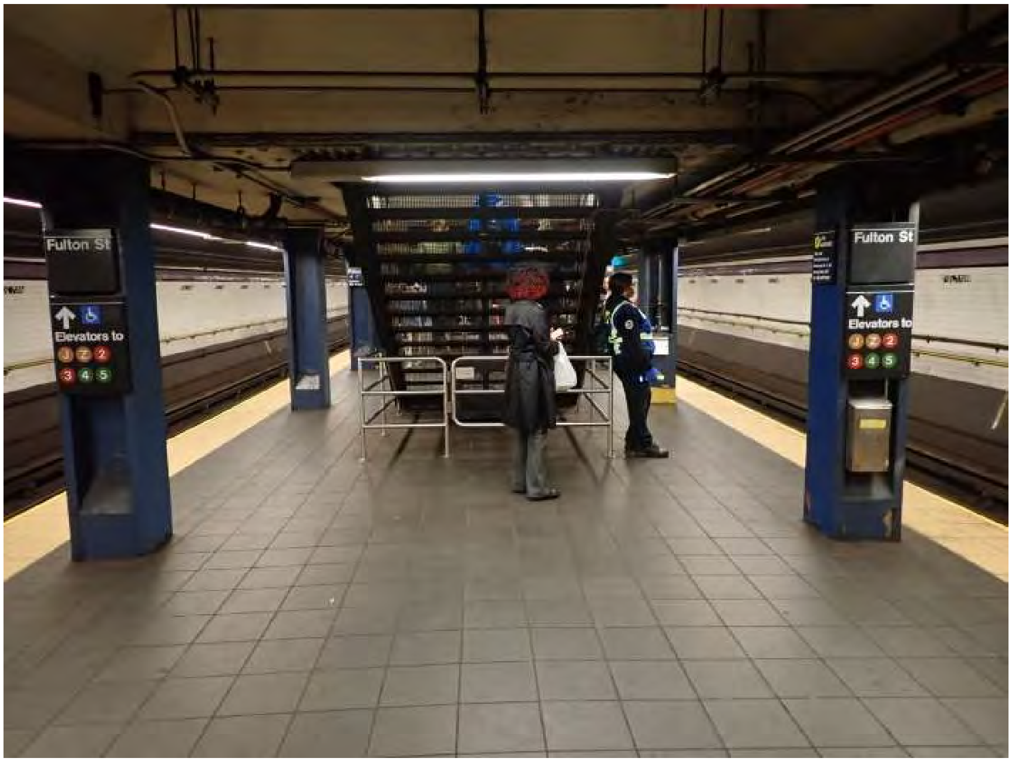

***Figure 3** – Typical platform view*
Fulton Street Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.9M to install APGs and $40.2M to install PSDs (See Appendix E).

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1.30 – MR 173 | High Street Station

Summary: *High Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 13" (see figure 1).*

Description

High Street Station is a below-grade station with one straight center / island platform. The platform structure is cast-in-place concrete. The platform width is approximately 19'-4" throughout. The platform is straight with two rows of columns measuring approximately 2'-6" from the platform edges. At the platform ends, the columns measure 2'-4" from the platform edge and 0'-6" from the staircase. The implementation of a platform edge barrier would reduce the currently non-compliant width of 28" to 13" or less* which would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
High Street Station

1.31 - MR-174 | Jay Street Metrotech

Summary: *Jay Street-MetroTech Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch width requirement for ADA compliant wheelchair movement would not be met at several stairs on both platforms. These stairs are not centered on the width of the platform, but are closer to the 'A' and 'C' track side of the platform. In these conditions, the remaining width would be 27" (see figure 1).*

Description

Jay Street-MetroTech Station is a below-grade station with two straight center / island platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 24'-8" throughout. Columns are spaced 15'-0" on center with column faces 3'-6" away from the platform edge. On both platforms, column faces are 3'-6" from the platform edge. Currently, there is an ADA-compliant path of travel between columns and the platform edge (3'-6"). The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 27" or less* would not allow for ADA compliant wheelchair movement.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

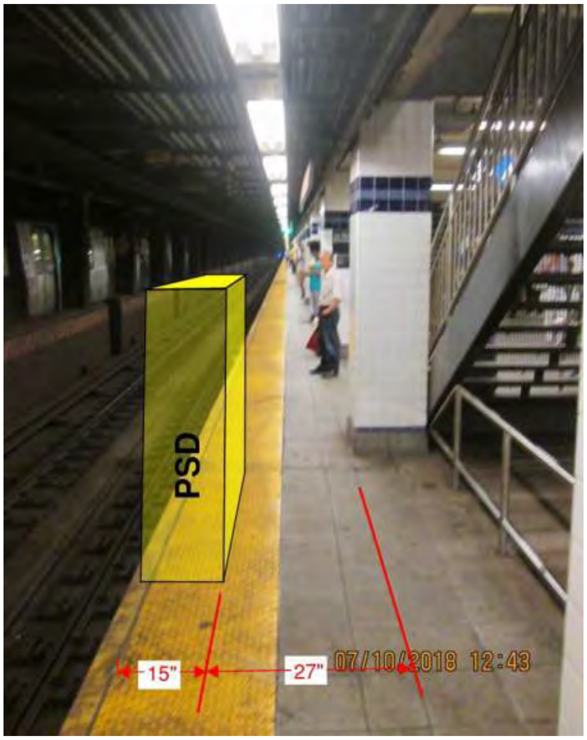

Figure 1 Non-Compliant ADA condition at stairs

1.32 – MR 175 | Hoyt Schermerhorn Station

Summary: *Hoyt Schermerhorn Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 25" (see Figure 1). This condition occurs at multiple stairs on both station platforms.*

Description

Hoyt Schermerhorn Street Station is a below-grade station with four straight center / island platforms - two open revenue platforms in the center and two abandoned platforms on the sides. The platform structures are cast-in-place concrete. The width of the platforms is approximately 20'-6" throughout tapering down to 16'-10" at the southern end of the station. There are three staircases along each revenue platform. These staircases are centered on the platform and flanked on both sides by the typical station columns, where the column face is 3'-4" away from adjacent platform edge. Passengers requiring an ADA-compliant path of travel can currently move along the platform in the 3'-4" between columns and the platform edge. As seen in Figure 1, the implementation of a platform edge barrier would reduce this width below the required minimum of 32" for pinch-points. The remaining 25" or less* would not allow for ADA-compliant wheelchair movement.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

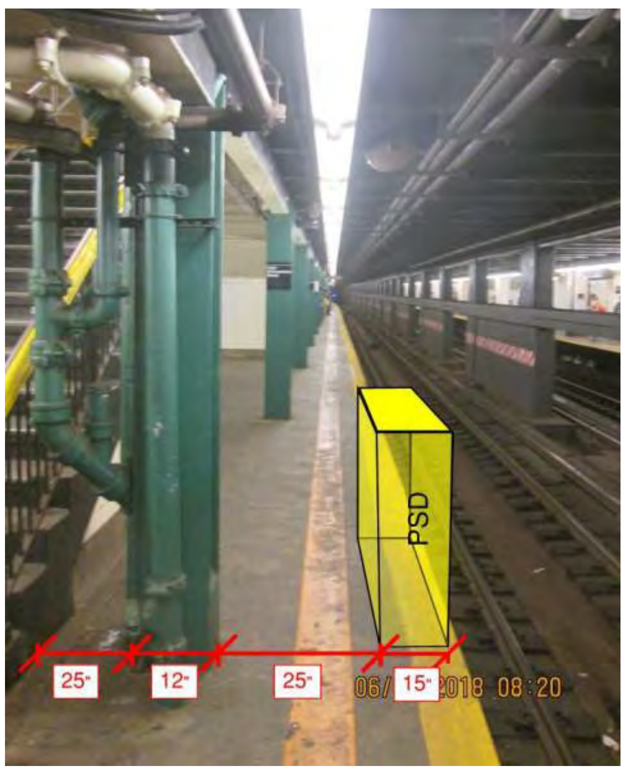

Figure 1: *Non-Compliant ADA condition at stairs (typical on all platforms)*
Hoyt Schermerhorn Street Station

1.33 – MR 176 | Lafayette Avenue Station

Summary: *Lafayette Avenue Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG and PSD system (see Appendix B). Existing power is adequate.*

Description

The Lafayette Avenue Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platform. The platform widths measure approximately 9'-8" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the edge of the station mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges are original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would be required for the installation of both APG and PSD systems.

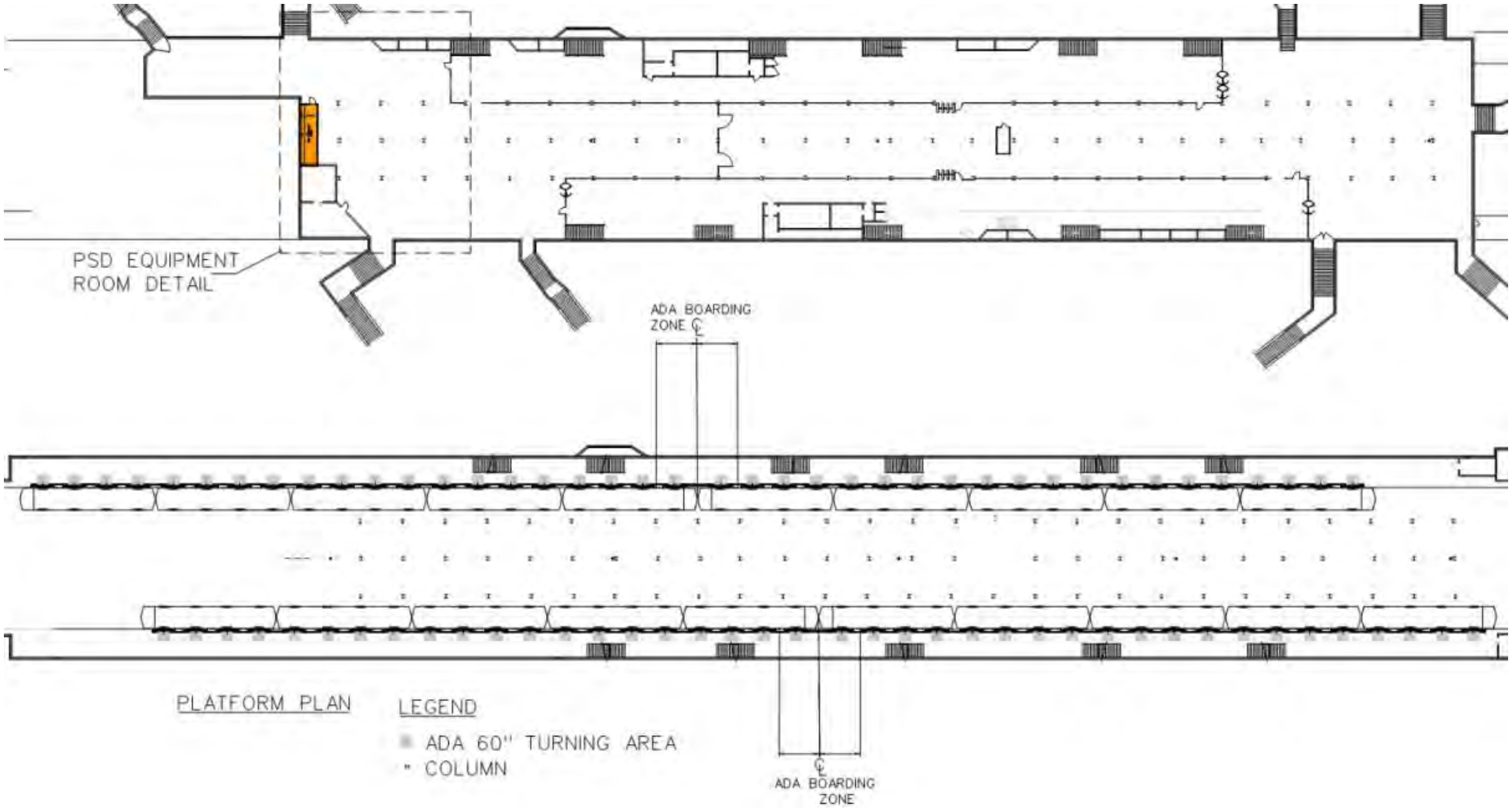

***Figure 1** – Overall plan*
Lafayette Avenue Station

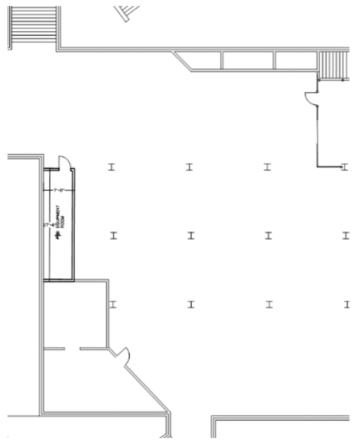

Figure 2 *– PSD Equipment Room Detail*
Lafayette Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal)

Station Name	Lafayette Ave.
Peak Demand Load from ConEd Report, (kW)	71.2
Apparent Power (kVA)	89.0
Station Peak Demand Load, Max Current, (A)	247.2
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	442
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	358
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve)

Station Name	Lafayette Ave.
Peak Demand Load from ConEd Report, (kW)	71.2
Apparent Power (kVA)	89.0
Station Peak Demand Load, Max Current, (A)	247.2
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	442
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	358
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 2. Power Capacity Analysis

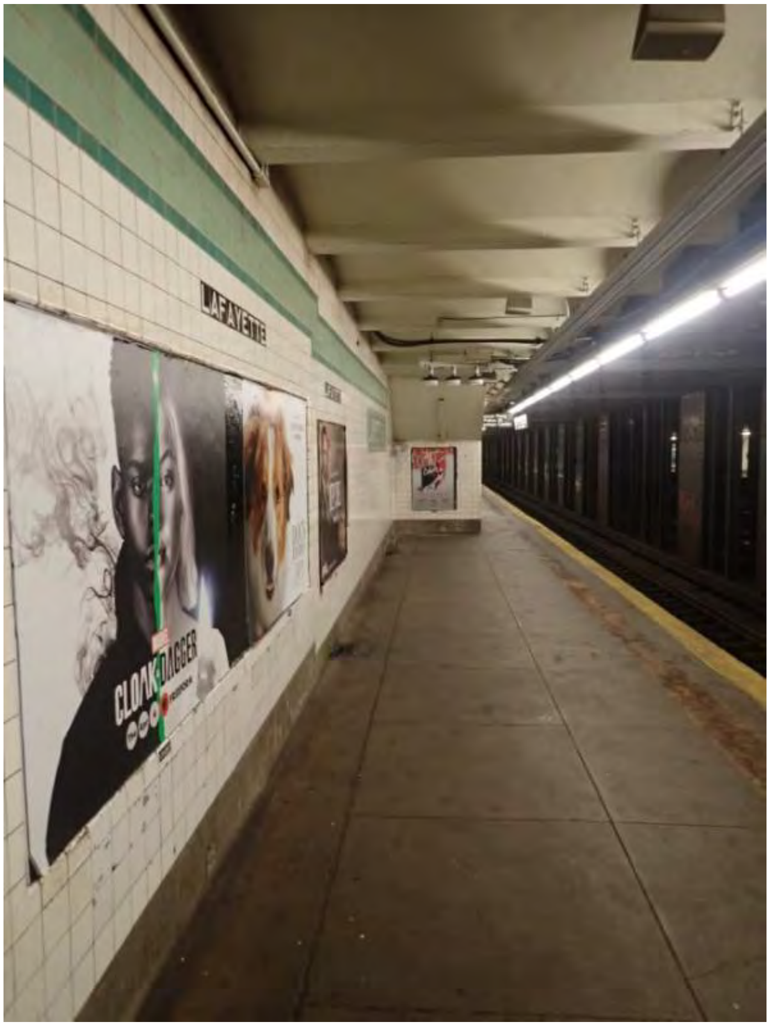

Figure 3 *– General platform view*
Lafayette Avenue Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.0M to install APGs and $40.8M to install PSDs (See Appendix E).

1.34 – MR 177 | Clinton Washington Avenue Station

Summary: *Clinton Washington Avenue Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Clinton Washington Avenue Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platform. The platform widths vary measure approximately 9'-8" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the southbound control area (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges are original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would be required for the installation of both APG and PSD systems.

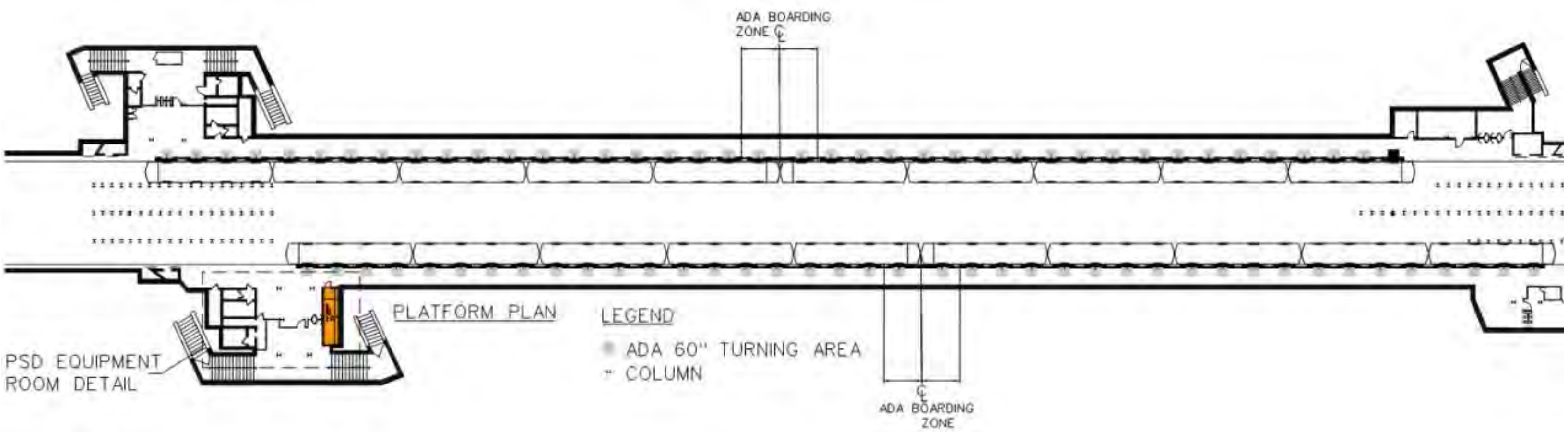

Figure 1 *– Overall plan*
Clinton Washington Avenue Station

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'A' & 'C' Line Stations
(Clinton Washington Avenue Station)

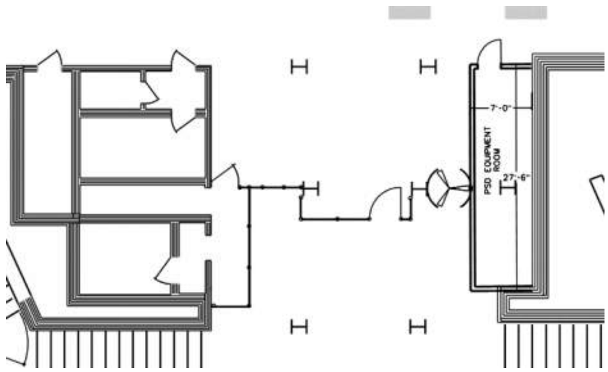

***Figure 2** – PSD Equipment Room Detail*
Clinton Washington Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of a APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal)

Station Name	Clinton & Washington Avenues
Peak Demand Load from ConEd Report, (kW)	52.8
Apparent Power (kVA)	66.0
Station Peak Demand Load, Max Current, (A)	183.3
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	378
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	422
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Clinton & Washington Avenues
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	52.8
Apparent Power (kVA)	66.0
Station Peak Demand Load, Max Current, (A)	183.3
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	378
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	422
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 2. Power Capacity Analysis

***Figure 3** – General platform view*
Clinton Washington Avenue Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.0M to install APGs and $40.8M to install PSDs (See Appendix E).

1.35 – MR 178 | Franklin Avenue Station

Summary: *Franklin Avenue Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of both an APG and PSD system (see Appendix B). Existing power is adequate.*

Description

The Franklin Avenue Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platforms. The platform widths measure approximately 9'-8" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located in the closed exit on the southbound platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges are original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would be required for the installation of both APG and PSD systems.

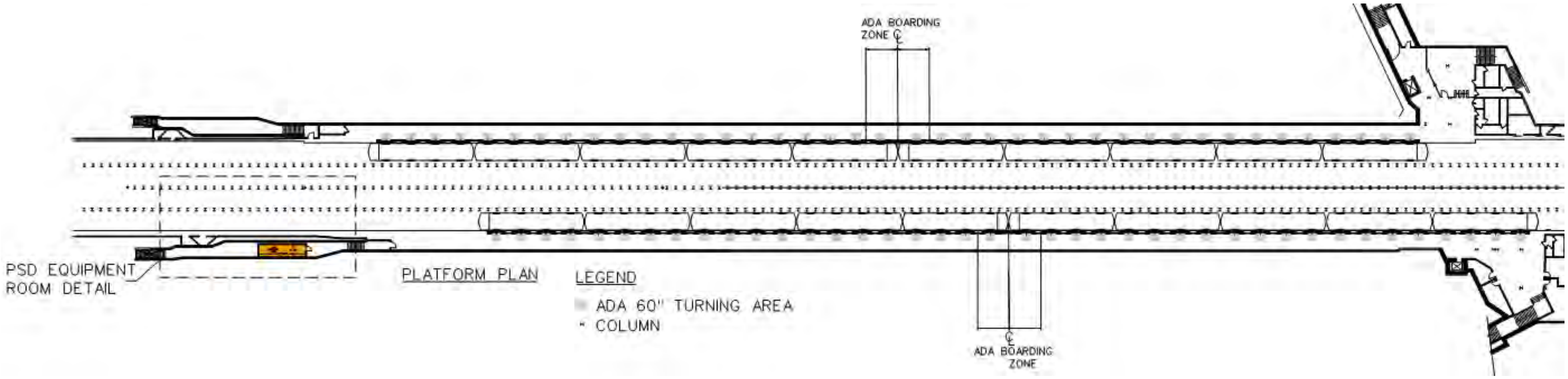

Figure 1 *– Overall plan*
Franklin Avenue Station

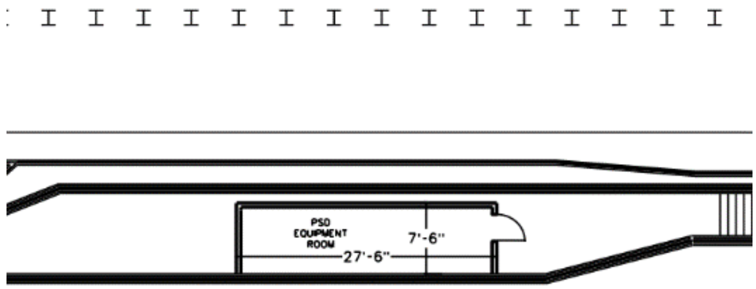

Figure 2 *– PSD Equipment Room Detail*
Franklin Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Franklin Avenue
Peak Demand Load from ConEd Report, (kW)	38.4
Apparent Power (kVA)	48.0
Station Peak Demand Load, Max Current, (A)	133.3
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	328
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	472
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Franklin Avenue
Peak Demand Load from ConEd Report, (kW)	38.4
Apparent Power (kVA)	48.0
Station Peak Demand Load, Max Current, (A)	133.3
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	328
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	472
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 2. Power Capacity Analysis

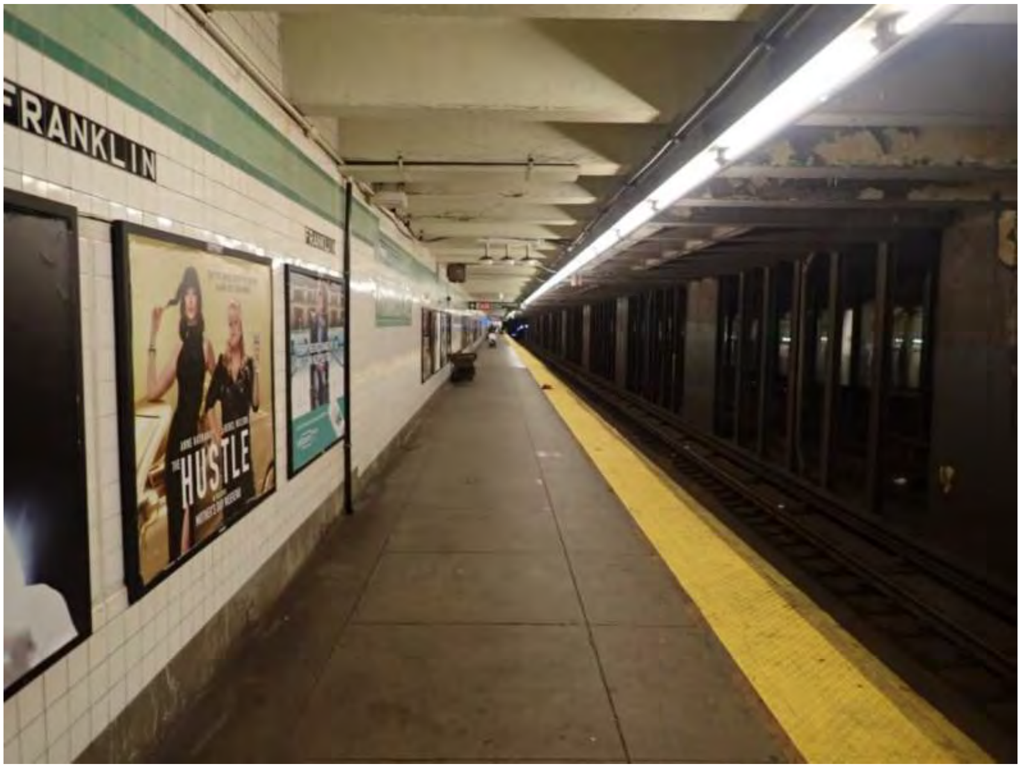

***Figure 3** – General platform view*
Franklin Avenue Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.0M to install APGs and $40.8M to install PSDs (See Appendix E).

1.36-A – MR 179 | Nostrand Avenue Station (Upper level)

Summary: *Nostrand Avenue Station is a two-level station, with the A-train service on the upper level, and the C-train service on the lower level. The upper level is feasible for both APGs and PSDs. There are two ceiling mounted signals located at the center of each platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG and PSD system (see Appendix B). Existing power is adequate.*

The lower level is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at the platform stairs as the remaining width would be 33" (see figure 1).

Description

The Nostrand Avenue Station is a below-grade station with two levels of straight side platforms **(see Figure 1).** The upper level services the express ‘A’ service and the lower level services the local ‘C’ service. This report focuses on the feasible upper level. The platform structures are cast-in-place concrete. There are columns evenly distributed along the platform edge measuring 3’-8” from the platform edge. The platform widths are approximately 24’-0” throughout. Ceiling heights measure no less than 7’-6” throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the southbound platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27’-6” x 7’-0”.

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges are original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would be required for the installation of both APG and PSD systems.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'A' & 'C' Line Stations
(Nostrand Avenue Station)

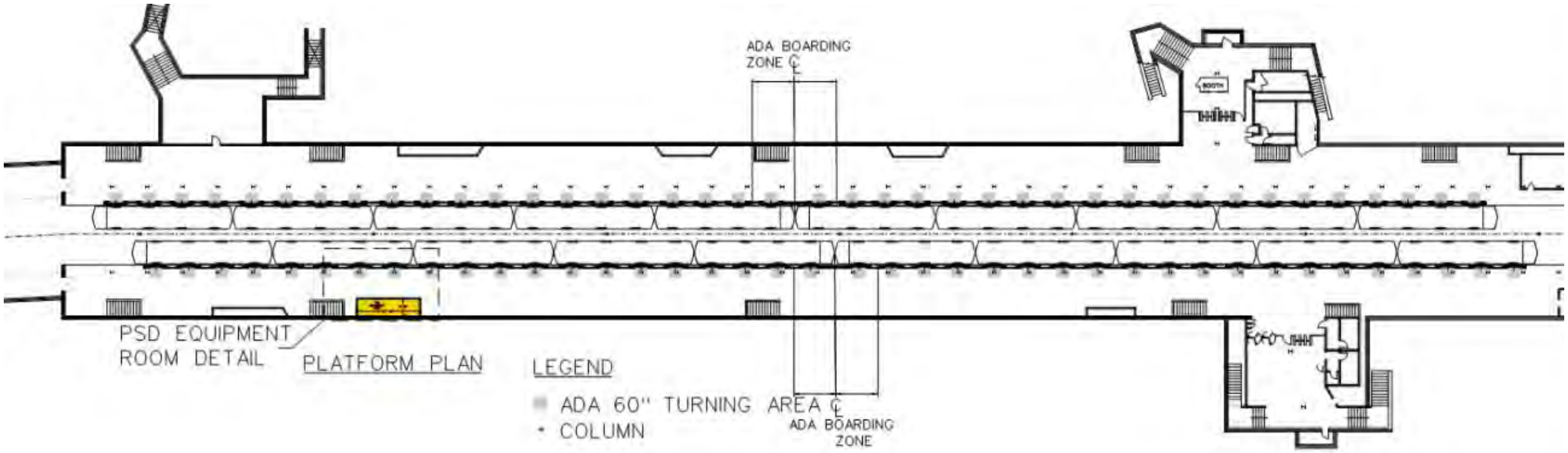

***Figure 1** – Overall plan – Upper level A-Train platform*
Nostrand Avenue Station

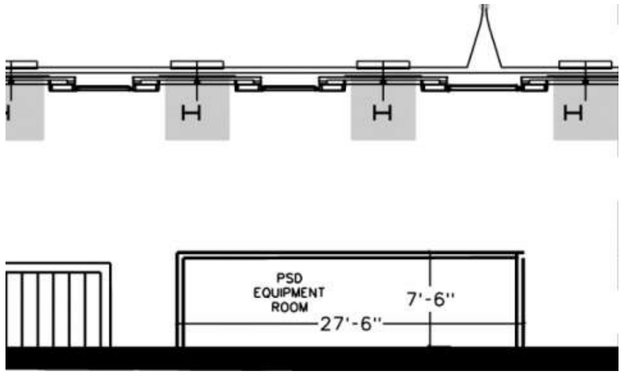

***Figure 2** – PSD Equipment Room Detail*
Nostrand Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of a APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Nostrand Avenue
Peak Demand Load from ConEd Report, (kW)	69.2
Apparent Power (kVA)	89.5
Station Peak Demand Load, Max Current, (A)	240.3
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	435
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	365
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Nostrand Avenue
Peak Demand Load from ConEd Report, (kW)	43.8
Apparent Power (kVA)	54.8
Station Peak Demand Load, Max Current, (A)	152.1
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	347
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	453
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service.

Table 2. Power Capacity Analysis

***Figure 3** – General platform view*
Nostrand Avenue Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.1M to install APGs and $43.3M to install PSDs (See Appendix E).

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1.36-C – MR 179 | Nostrand Avenue Station (Lower level)

Summary: *Nostrand Avenue Station is a two-level station, with the A-train service on the upper level, and the C-train service on the lower level. The upper level is feasible for both APGs and PSDs (see prior report).*

The lower level is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at the platform stairs as the remaining width would be 33" (see figure 1).

The Nostrand Avenue Station is a below-grade station with two levels of straight side platforms. The upper level services the express 'A' service and the lower level services the local 'C' service. This report focuses on the infeasible lower level. The platforms do not have columns. There are five sets of stairs on each platform placed at 4'-0" from the platform edge. The implementation of a platform edge barrier would reduce the currently compliant width of 48" to 33" or less* which would not allow for an ADA-compliant corridor width of 36" for wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – Non-Compliant ADA condition
Nostrand Avenue Station – lower level C-train platform

1.37 – MR 180 | Kingston Throop Avenue Station

Summary: *Kingston Throop Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of both APG and PSD systems (see Appendix B). Existing power is adequate.*

Description

The Kingston Throop Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns on the platforms. The platform widths are approximately 9'-8" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the north end of the northbound platform (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges are original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would be required for the installation of both APG and PSD systems.

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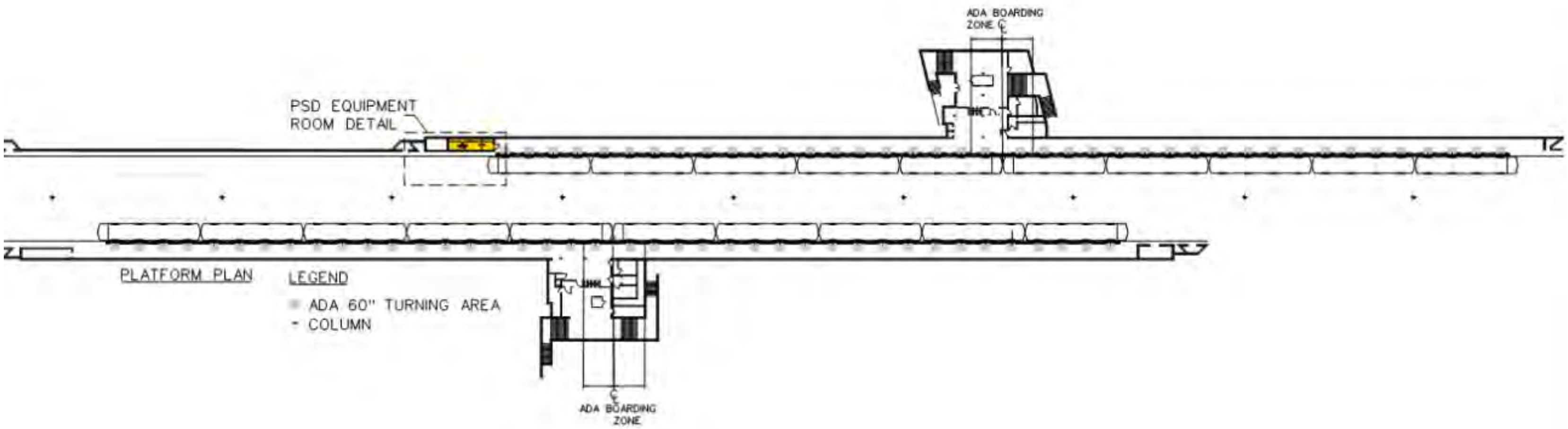

Figure 1 *– Overall plan*
Kinston Throop Station

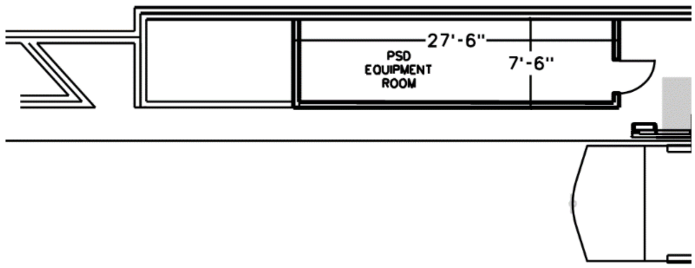

***Figure 2** – PSD Equipment Room Detail*
174th - 175th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

These obstructions do not present an impediment to the installation of PSDs.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of a APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Kingston Throop Avenues
Peak Demand Load from ConEd Report, (kW)	73.6
Apparent Power (kVA)	92.0
Station Peak Demand Load, Max Current, (A)	255.6
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	450
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	349.85
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Kingston Throop Avenues
Peak Demand Load from ConEd Report, (kW)	73.6
Apparent Power (kVA)	92.0
Station Peak Demand Load, Max Current, (A)	255.6
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	450
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	349.85
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 2. Power Capacity Analysis

***Figure 3** – General platform view*
Kingston Throop Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.6M to install APGs and $40.0M to install PSDs (See Appendix E).

1.38 – MR 181 | Utica Avenue Station

Summary: *Utica Avenue Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). There are four ceiling mounted signals located at the platform edges which would require relocation to implement a full height PSD system. Existing power is adequate.*

Description

Utica Avenue Station is a below-grade station with two center / island platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are distributed evenly in two rows and measure 4'-3" from the platform edge. The platform widths vary from approximately 17'-8" to 27'-8". Ceiling heights measure no less than 7'-6" throughout. Two signals on each of the express platform edges will require relocation for the installation of a full-height PSD.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the lower station mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are mildly curved. Therefore, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

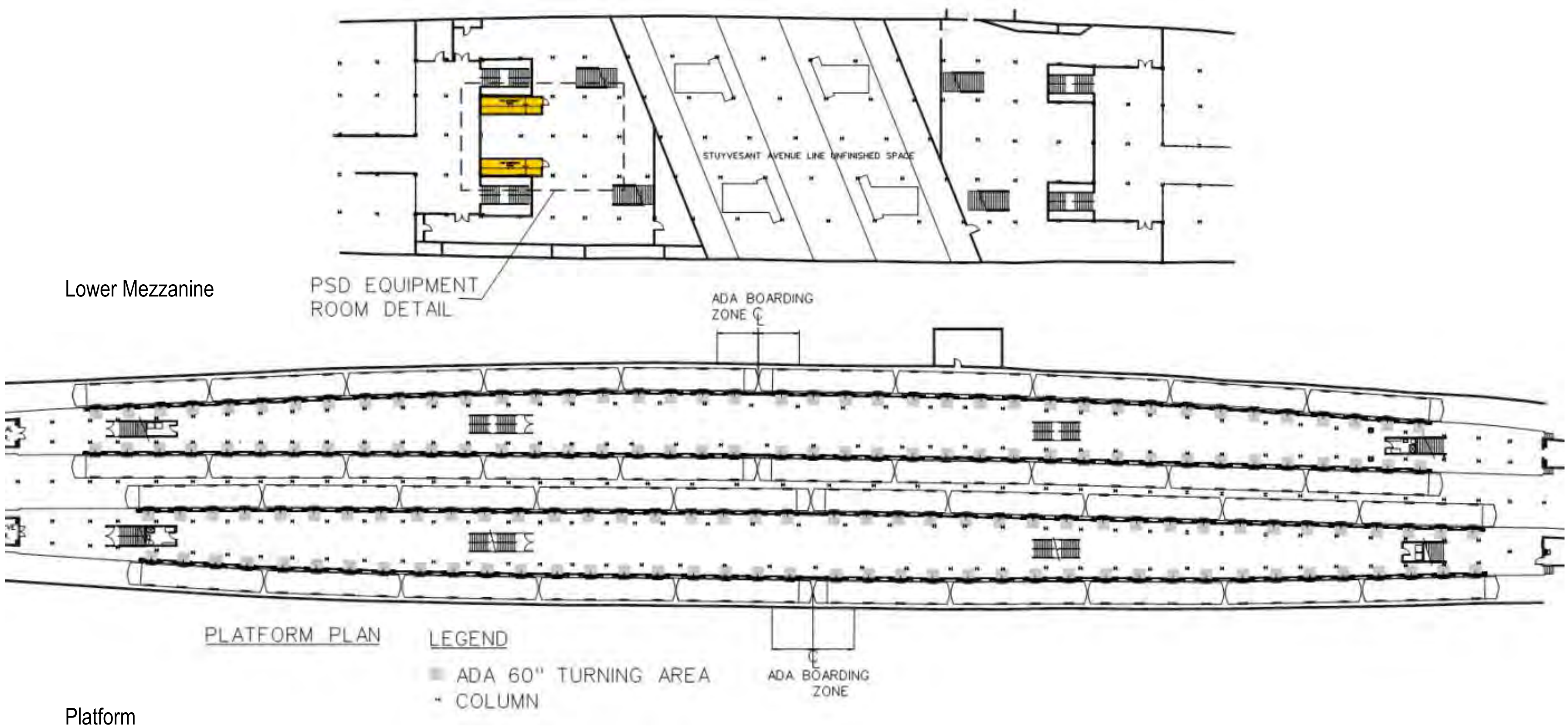

***Figure 1** – Overall Station Plan*
Utica Avenue Station

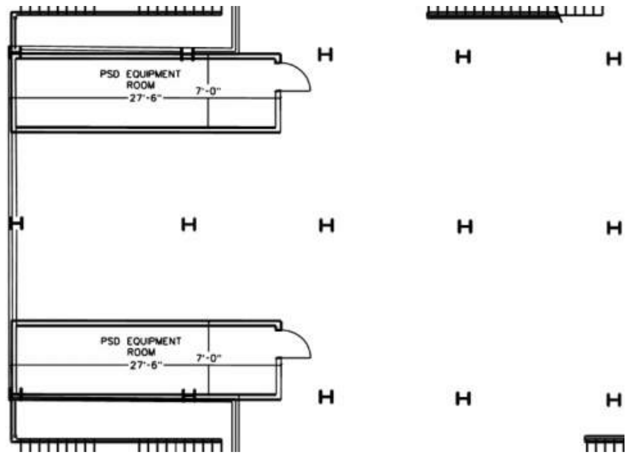

Figure 2 *– PSD Equipment Room Detail*
Utica Avenue Station- lower mezzanine

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Utica Avenue
Peak Demand Load from ConEd Report, (kW)	111.2
Apparent Power (kVA)	139.0
Station Peak Demand Load, Max Current, (A)	386.1
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	727
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	73
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis

Station
Power Capacity Analysis (Reserve Service)

Station Name	Utica Avenue
Peak Demand Load from ConEd Report, (kW)	111.2
Apparent Power (kVA)	139.0
Station Peak Demand Load, Max Current, (A)	386.1
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	727
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	73
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 2. Power Capacity Analysis

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Figure 3 *– Typical platform view*
Utica Avenue Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The cost of installation for the A-train for this station is estimated to be $31.1M to install APGs and $39.5M to install PSDs. The cost of installation for the C-train for this station is estimated to be $31.1M to install APGs and $39.5M to install PSDs (See Appendix E).

1.39 – MR 182 | Ralph Avenue Station

Summary: *Ralph Avenue Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of both APG and PSD systems (see Appendix B). Existing power is adequate.*

Description

The Ralph Avenue Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platform. The platform widths measure approximately 9'-8" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the edge of the station mezzanine (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges are original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would be required for the installation of both APG and PSD systems.

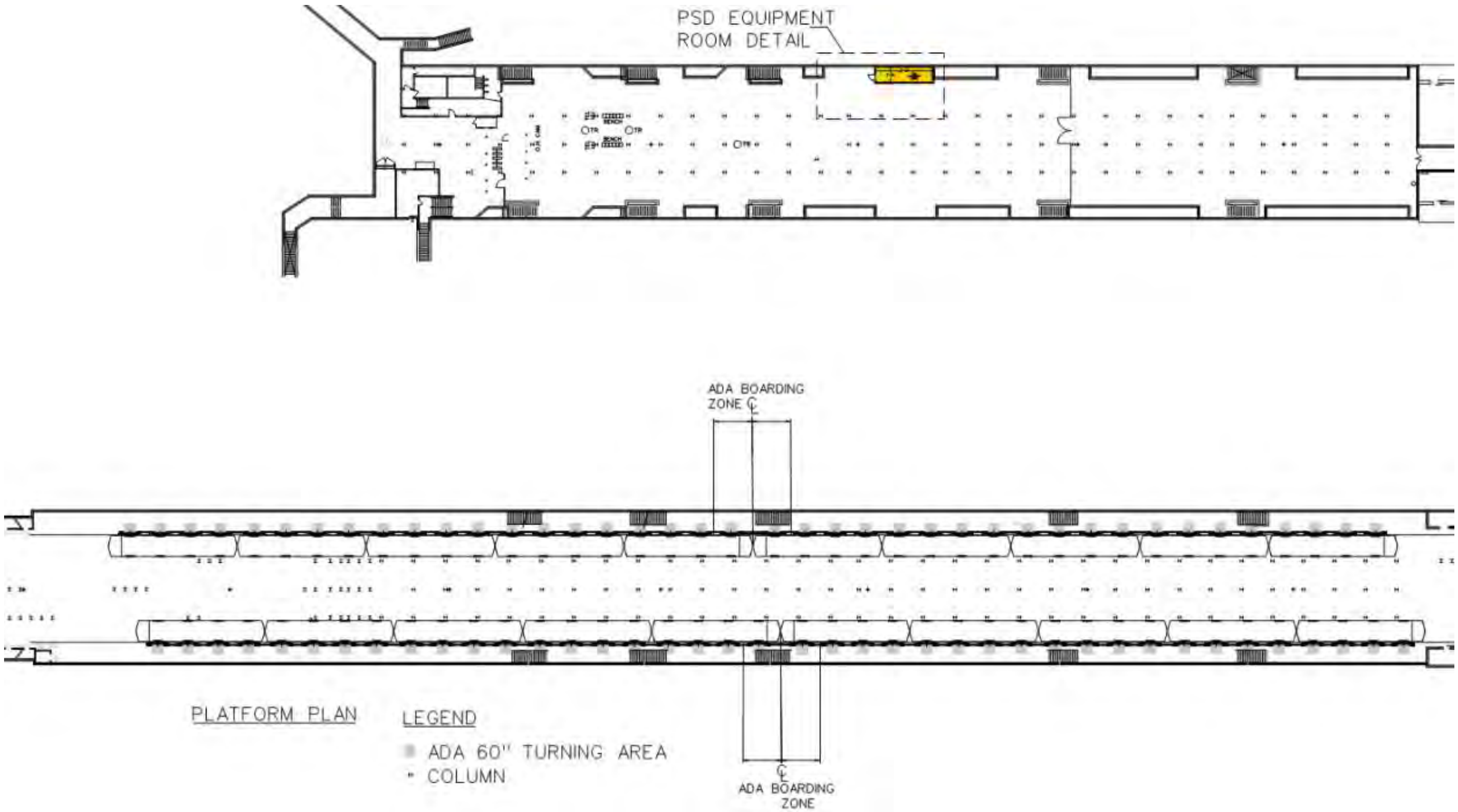


***Figure 1** – Overall plan*
Ralph Avenue Station

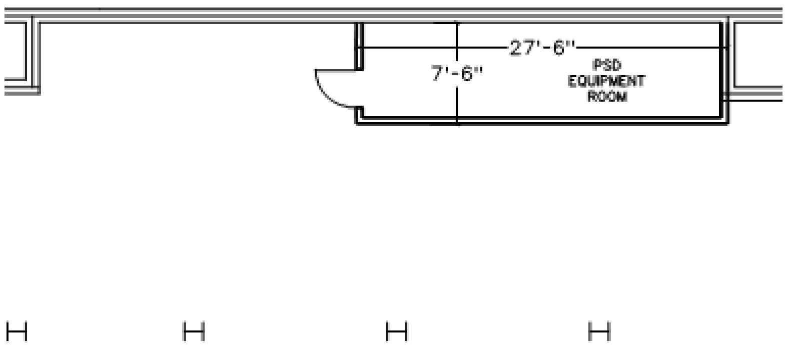


***Figure 2** – PSD Equipment Room Detail*
Ralph Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of a APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Ralph Avenue
Peak Demand Load from ConEd Report, (kW)	72.8
Apparent Power (kVA)	91.0
Station Peak Demand Load, Max Current, (A)	252.8
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	447
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	353
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey. The 1 line diagram provided is not legible and seems to be old. From the size of the equipment, it is safe to determine service to be 800A. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Ralph Avenue
Peak Demand Load from ConEd Report, (kW)	72.8
Apparent Power (kVA)	91.0
Station Peak Demand Load, Max Current, (A)	252.8
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	447
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	353
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey. The 1 line diagram provided is not legible and seems to be old. From the size of the equipment, it is safe to determine service to be 800A. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 2. Power Capacity Analysis

***Figure 3** – General platform view*
Ralph Avenue Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.5M to install APGs and $39.9M to install PSDs (See Appendix E).

1.40 – MR 183 | Rockaway Avenue Station

Summary: *Rockaway Avenue Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of both APG and PSD systems (see Appendix B). Existing power is adequate.*

Description

The Rockaway Avenue Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platforms. The platform widths measure approximately 9'-4" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the edge of the station mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges are original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would be required for the installation of both APG and PSD systems.

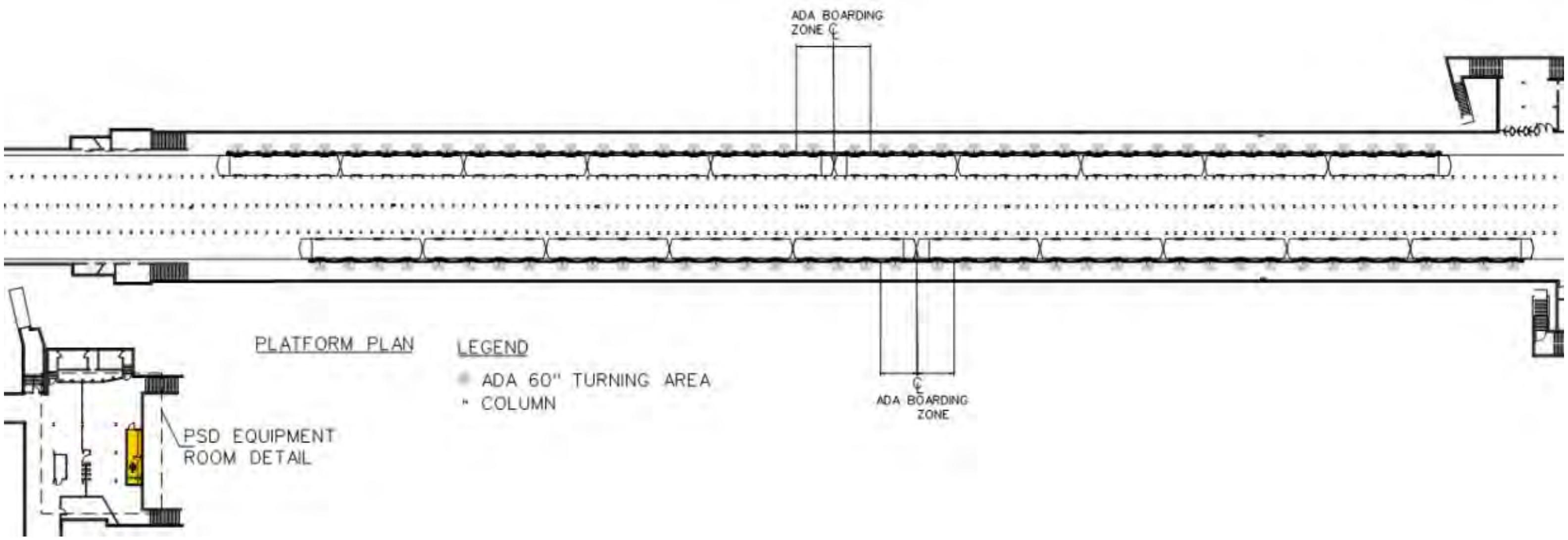


Figure 1 *– Overall plan*
Rockaway Avenue Station

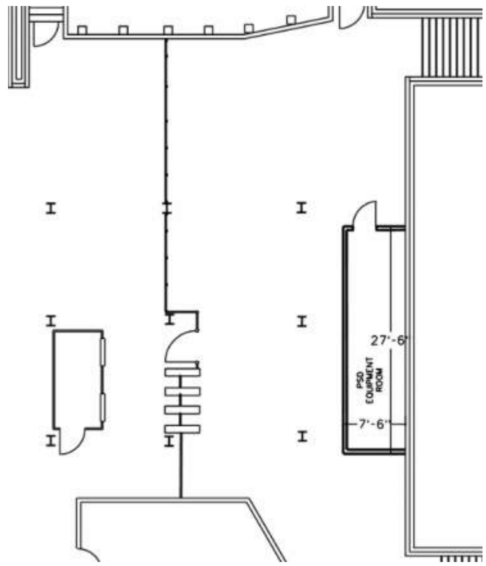


***Figure 2** – PSD Equipment Room Detail*
Rockaway Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of a APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal Service)

Station Name	Rockaway Avenue
Peak Demand Load from ConEd Report, (kW)	49.6
Apparent Power (kVA)	62.0
Station Peak Demand Load, Max Current, (A)	172.2
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	367
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	433
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis

Station
Power Capacity Analysis (Reserve Service)

Station Name	Rockaway Avenue
Peak Demand Load from ConEd Report, (kW)	49.6
Apparent Power (kVA)	62.0
Station Peak Demand Load, Max Current, (A)	172.2
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	367
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	433
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 2. Power Capacity Analysis

***Figure 3** – General platform view*
Rockaway Avenue Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.8M to install APGs and $42.1M to install PSDs (See Appendix E).

1.41 – MR 184 | Broadway Junction Station

Summary: *Broadway Junction Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). There are four ceiling mounted signals located at the platform edges which would require relocation to implement a full height PSD system. Existing power is adequate.*

Description

Broadway Junction Station is a below-grade station with two center / island platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are distributed evenly along two rows on each platform and measure 4'-2" from the platform edge. The platform widths vary from approximately 17'-8" to 21'-6". Ceiling heights measure no less than 7'-6" throughout. There are two signals above the edges of each express platform which will require relocation for the installation of full-height PSDs.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*: This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The two equipment rooms can be located at the center of each platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

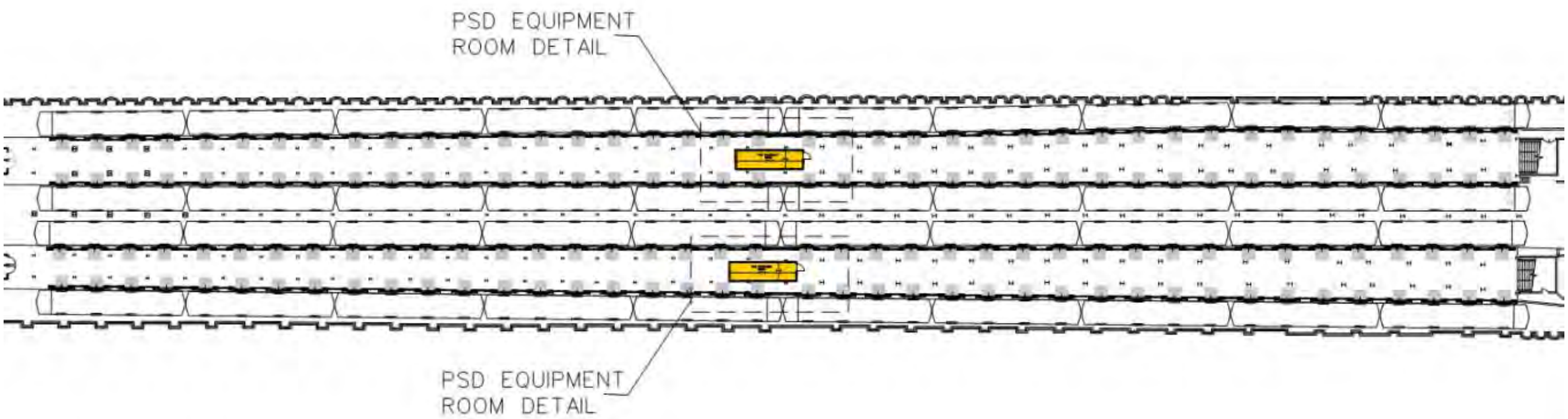
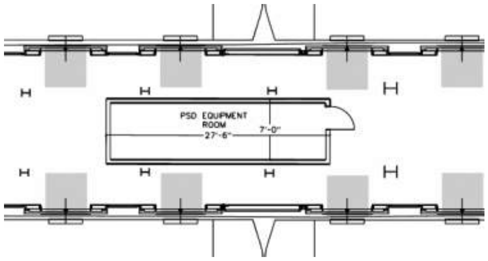


Figure 1 – Overall Station Plan
Broadway Junction Station

Tier 2-3 Report on Feasibility of Platform Edge Barriers for ‘A’ & ‘C’ Line Stations
(Broadway Junction Station)



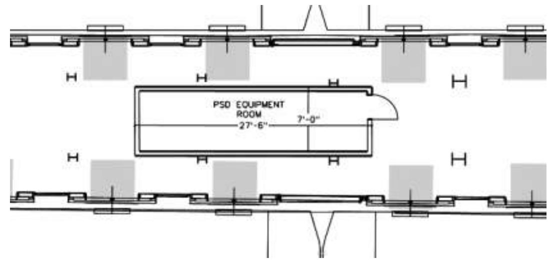


***Figure 2** & 3– PSD Equipment Room Detail*
Broadway Junction Station

Platform obstructions within 5’ of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60” circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Broadway Jct. / East NY
Peak Demand Load from ConEd Report, (kW)	128.8
Apparent Power (kVA)	161.0
Station Peak Demand Load, Max Current, (A)	447.2
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	788
Station Service Power Capacity, (A)	1000
Service Spare Capacity, (A)	212
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 1000A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Broadway Jct. / East NY
Peak Demand Load from ConEd Report, (kW)	128.8
Apparent Power (kVA)	161.0
Station Peak Demand Load, Max Current, (A)	447.2
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	788
Station Service Power Capacity, (A)	1000
Service Spare Capacity, (A)	212
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 1000A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 2. Power Capacity Analysis

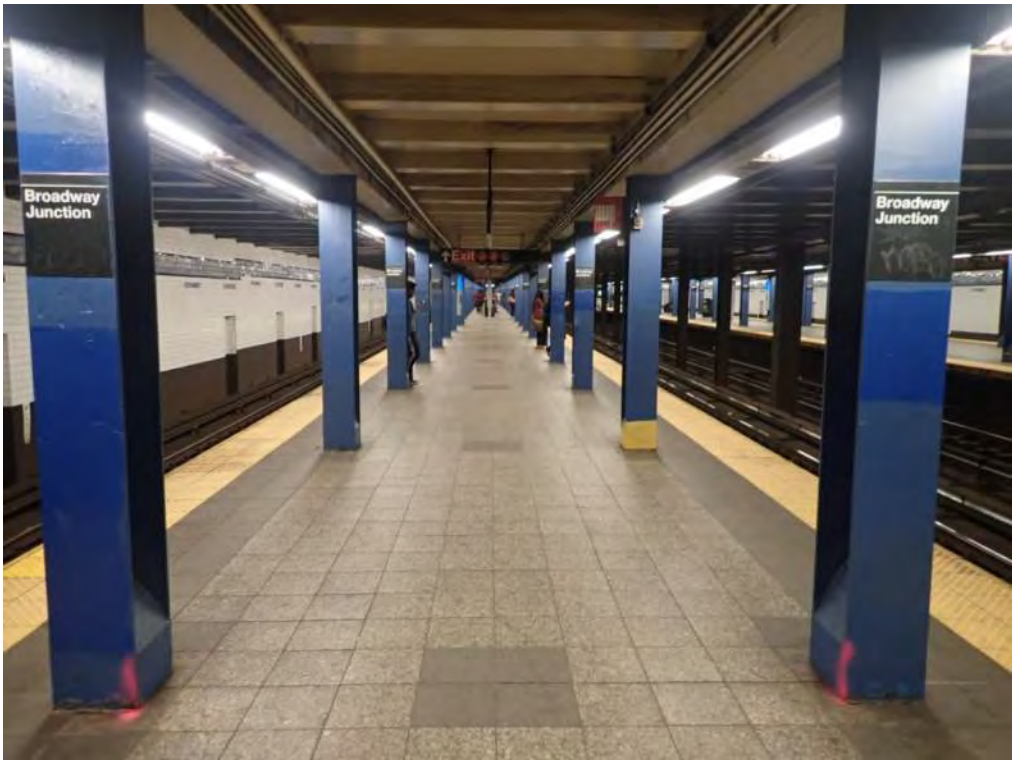


***Figure 3** – Typical platform view*
Broadway Junction Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The cost of installation for the A-train for this station is estimated to be $31.0M to install APGs and $39.5M to install PSDs. The cost of installation for the C-train for this station is estimated to be $31.0M to install APGs and $39.5M to install PSDs (See Appendix E)

1.42 – MR 185 | Liberty Avenue Station

Summary: *Liberty Avenue Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of both APG and PSD systems (see Appendix B). Existing power is adequate.*

Description

The Liberty Avenue Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platform. The platform widths measure approximately 9'-8" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located in the station mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges are original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would be required for the installation of both APG and PSD systems.

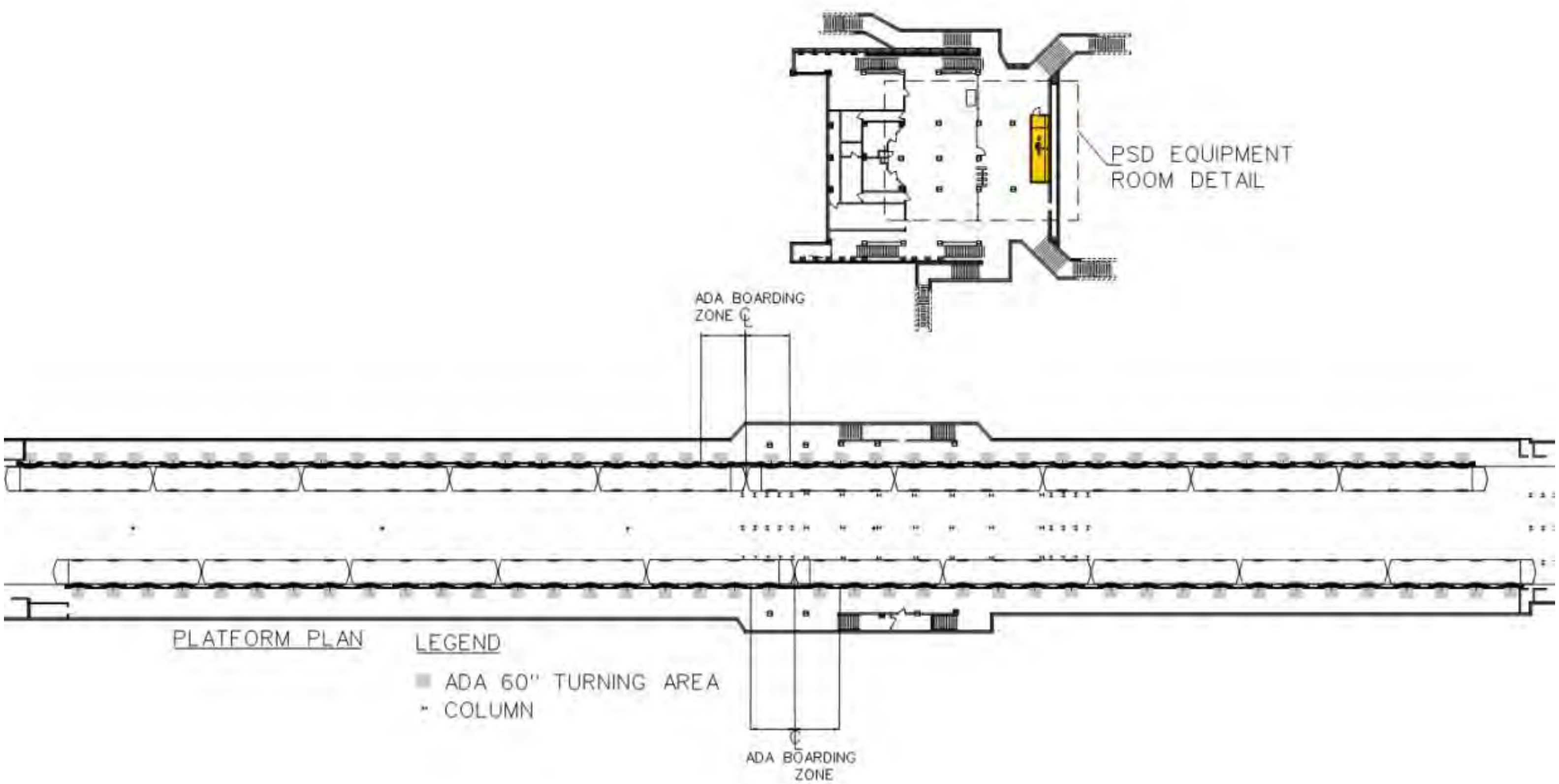


***Figure 1** – Overall plan*
Liberty Avenue Station

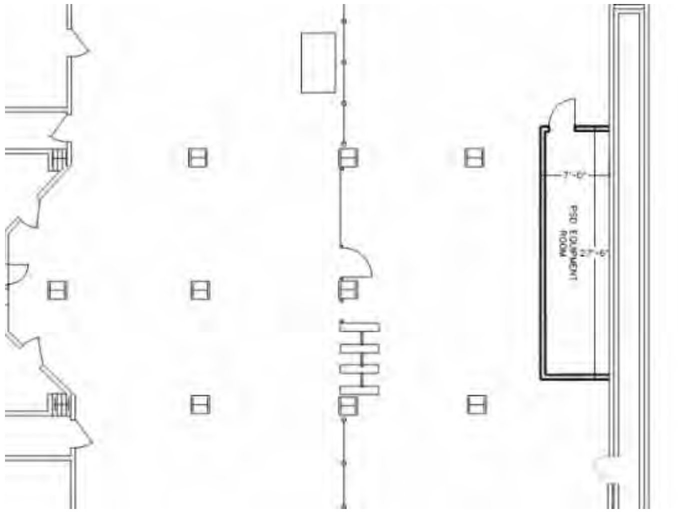


***Figure 2** – PSD Equipment Room Detail*
Liberty Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal Service)

Station Name	Liberty Avenue Pennsylvania Ave.
Peak Demand Load from ConEd Report, (kW)	57.6
Apparent Power (kVA)	72.0
Station Peak Demand Load, Max Current, (A)	200.0
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	395
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	405
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis

Station
Power Capacity Analysis (Reserve Service)

Station Name	Liberty Avenue Pennsylvania Ave.
Peak Demand Load from ConEd Report, (kW)	57.6
Apparent Power (kVA)	72.0
Station Peak Demand Load, Max Current, (A)	200.0
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	395
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	405
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 2. Power Capacity Analysis

Figure 3 *– General platform view*
Liberty Avenue Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $30.9M to install APGs and $38.9M to install PSDs (See Appendix E).

1.43 – MR 186 | Van Siclen Avenue Station

Summary: *Van Siclen Avenue Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Van Siclen Avenue Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platform. The platform widths measure approximately 9'-8" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located in the station mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges are original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would be required for the installation of both APG and PSD systems.

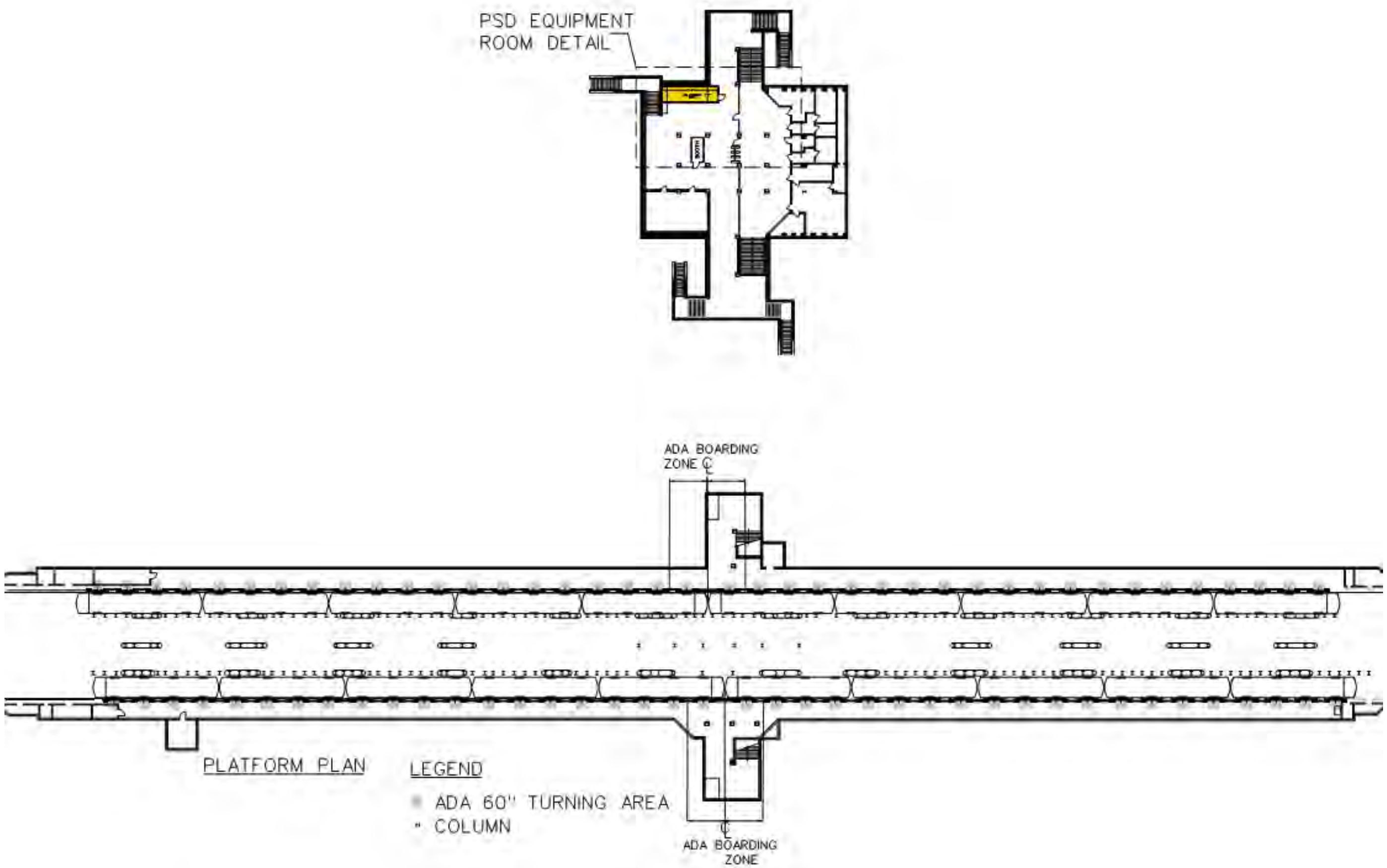


***Figure 2** – Overall station plan*
Van Siclen Avenue Station

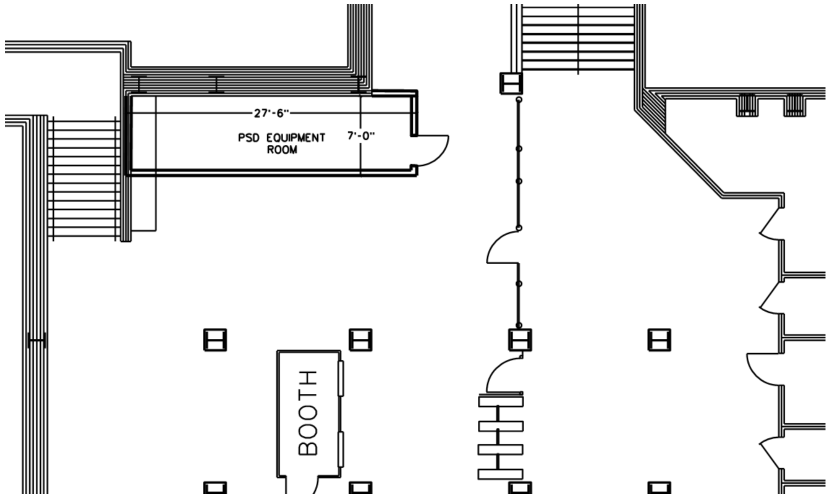


Figure 2 *– PSD Equipment Room Detail*
Van Siclen Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Van Siclen Avenue Pitkin Ave.
Peak Demand Load from ConEd Report, (kW)	87.2
Apparent Power (kVA)	109.0
Station Peak Demand Load, Max Current, (A)	302.8
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	497
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	302
Is Electrical Service Adequate?	Yes
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Van Siclen Avenue Pitkin Ave.
Peak Demand Load from ConEd Report, (kW)	87.2
Apparent Power (kVA)	109.0
Station Peak Demand Load, Max Current, (A)	302.8
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	497
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	302
Is Electrical Service Adequate?	Yes
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 2. Power Capacity Analysis

Figure 3 *– General platform view*
Van Siclen Avenue Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $30.6M to install APGs and $38.5M to install PSDs (See Appendix E).

1.44 – MR 187 | Shepherd Avenue Station

Summary: *Shepherd Avenue Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of both APG and PSD systems (see Appendix B). Existing power is adequate.*

Description

The Shepherd Avenue Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platforms. The platform widths vary from 9'-8" to 11'-2". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located in the station mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges are original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would be required for the installation of both APG and PSD systems.

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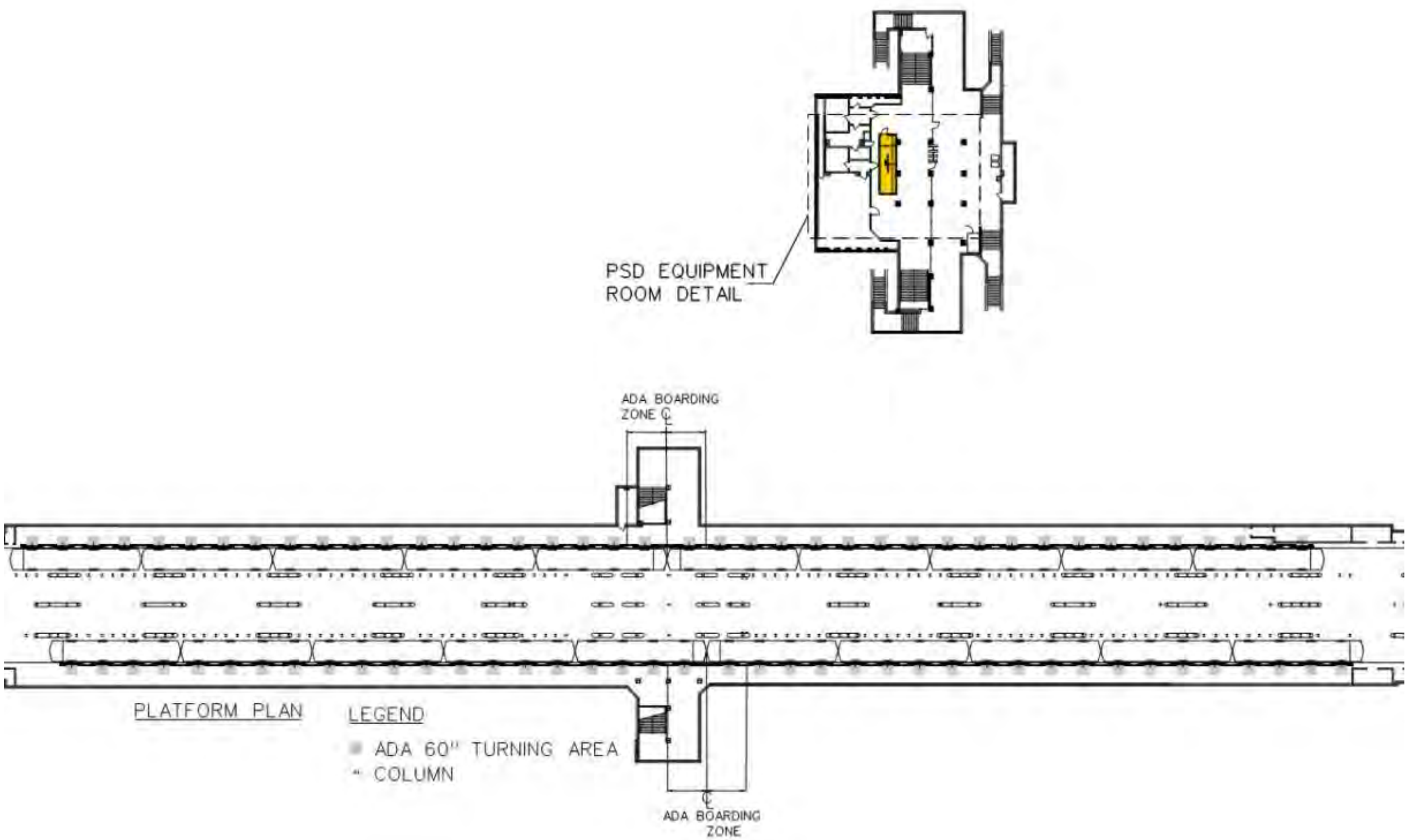

Figure 1 *– Overall plan*
Shepherd Avenue Station

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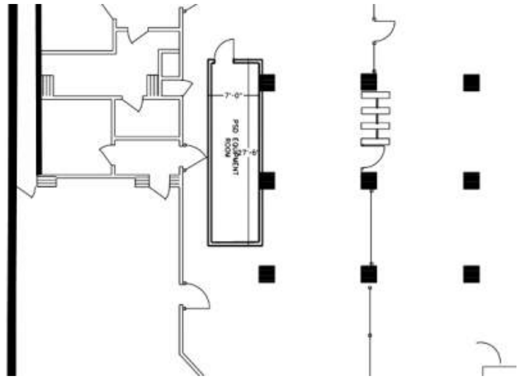

Figure 2 *– PSD Equipment Room Detail*
Shepherd Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Shepherd Avenue
Peak Demand Load from ConEd Report, (kW)	56.8
Apparent Power (kVA)	71.0
Station Peak Demand Load, Max Current, (A)	197.2
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	392
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	408
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Shepherd Avenue
Peak Demand Load from ConEd Report, (kW)	56.8
Apparent Power (kVA)	71.0
Station Peak Demand Load, Max Current, (A)	197.2
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	392
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	408
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 2. Power Capacity Analysis

***Figure 3** – General platform view*
Shepherd Avenue Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $30.9M to install APGs and $38.9M to install PSDs (See Appendix E).

1.45 – MR 188 | Euclid Avenue Station

Summary: *Euclid Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met on the northbound platform as the remaining width would be 29" (see figure 1).*

Description

Euclid Avenue Station is a below-grade station with two straight center / island platforms. The platform structures are cast-in-place concrete. The platform widths vary from 9'-8" to 16'-10". The platforms are slightly bowed with two rows of columns approximately 3'-8" from edge of platform. At staircase P4, the columns measure 3'-8" from the platform edge and 1'-4" from the stair railing wall. The implementation of a platform edge barrier would reduce the currently compliant width of 44" to 29" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

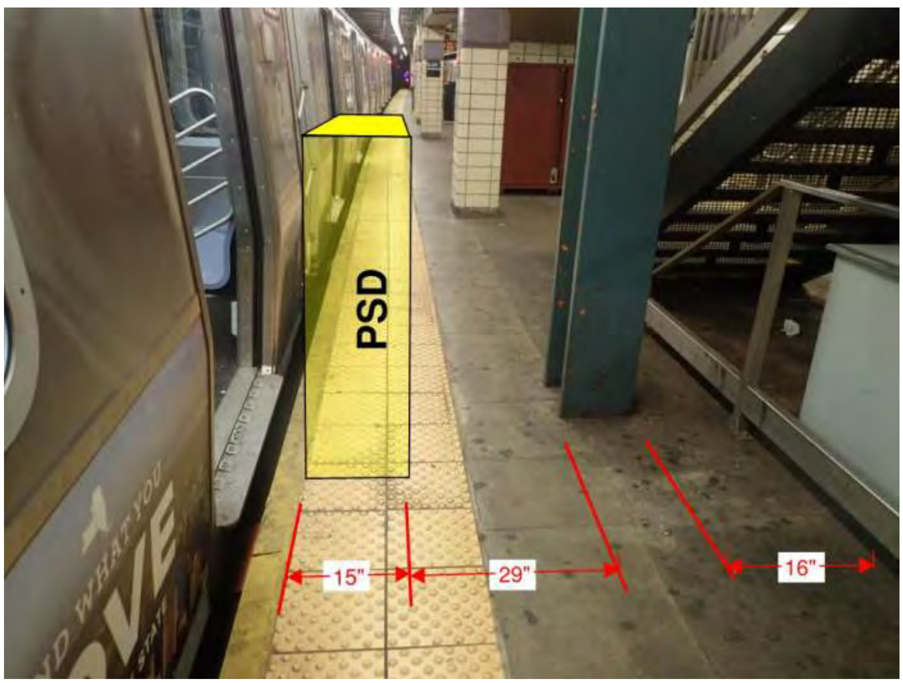

Figure 1 – Non-Compliant ADA condition
Euclid Avenue

1.46 – MR 189 | Grant Avenue Station

Summary: *Grant Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 21" (see figure 1).*

Description

Grant Avenue Station is a below-grade station with one straight center / island platform. The platform structures are cast-in-place concrete. The platform width is approximately 18'-0" throughout. There are two rows of columns measuring approximately 3'-0" from the platform edges. At the platform staircases, the columns measure 3'-0" from the platform edge and 2'-2" from the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 36" to 21" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
Grant Avenue

1.47 – MR 190 | 80th Street Station

Summary: *80th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 31" (see figure 1).*

Description

80th Street Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms are 11'-2" throughout. The stair railings are approximately 3'-10" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum corridor requirement of 36". The remaining 31" or less* would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – Non-Compliant ADA condition
80th Street

1.48 – MR 191 | 88th Avenue Station

Summary: *88th Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 33" (see figure 1).*

Description

88th Avenue Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is 12'-2" throughout. The stair railings are approximately 4'-0" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum corridor requirement of 36". The remaining 33" or less* would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

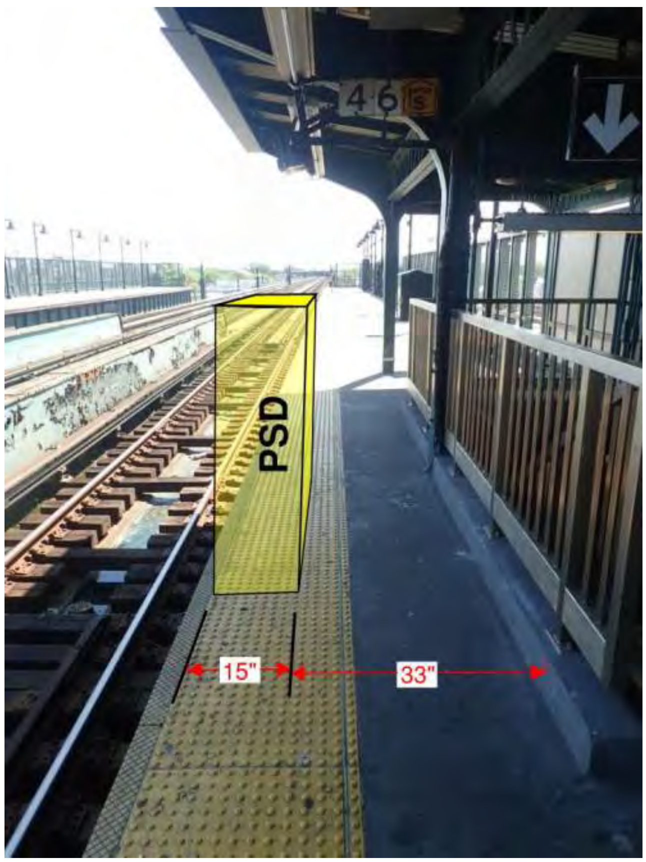

Figure 1 – Non-Compliant ADA condition
88th Avenue

1.49 – MR 192 | Rockaway Boulevard Station

Summary: *Rockaway Boulevard Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 29" (see figure 1).*

Description

Rockaway Boulevard Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is 10'-10" throughout. The stair railings are approximately 3'-8" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum corridor requirement of 36". The remaining 29" or less* would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

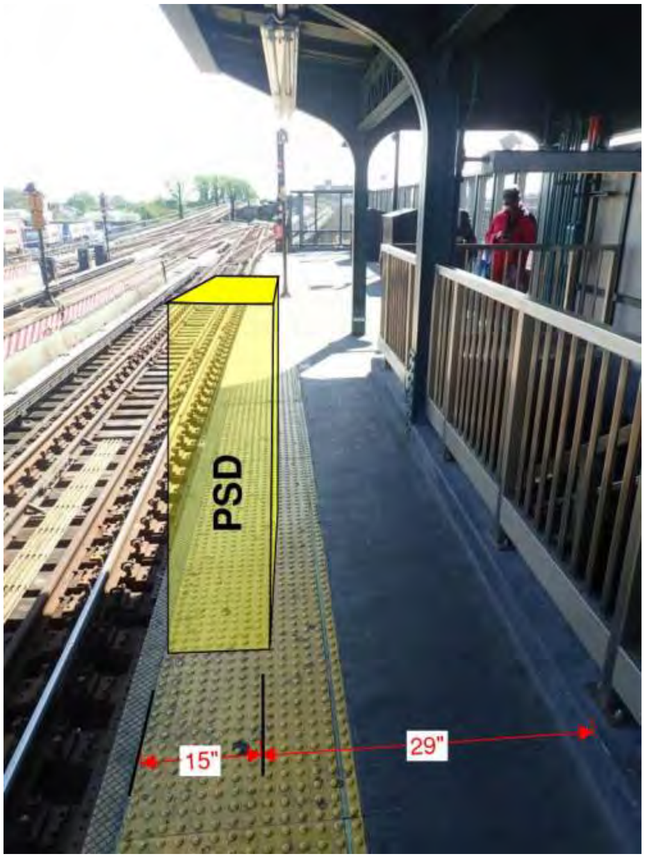

Figure 1 – Non-Compliant ADA condition
Rockaway Boulevard

1.50 – MR 193 | 104th Street Station

Summary: *104th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 29" (see figure 1).*

Description

104th Street Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is 10'-10" throughout. The stair railings are approximately 3'-8" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum corridor requirement of 36". The remaining 29" or less* would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

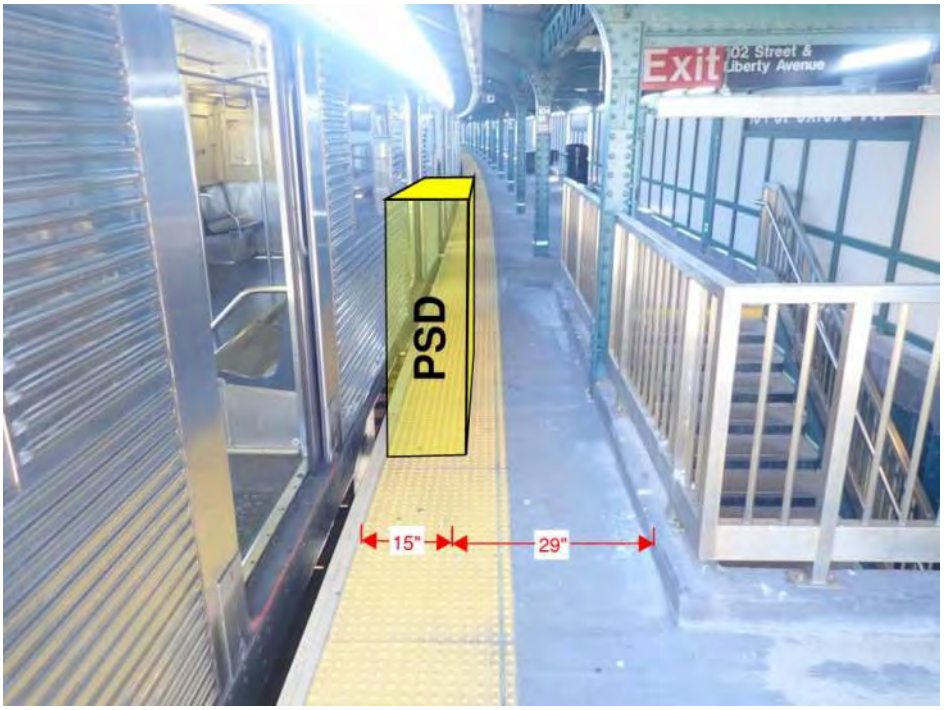

Figure 1 – Non-Compliant ADA condition
104th Street

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1.51 – MR 194 | 111th Street Station

Summary: *111th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 33" (see figure 1).*

Description

111th Street Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is 11'-2" throughout. The stair railings are approximately 4'-0" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum corridor requirement of 36". The remaining 33" or less* would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – Non-Compliant ADA condition
111th Street

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1.52 – MR 195 | Lefferts Boulevard Station

Summary: *Lefferts Boulevard Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 17" (see figure 1).*

Description

Lefferts Boulevard Station is an elevated station with one nearly straight center / island platform. The platform structure is cast-in-place concrete. The platform width varies from 15'-0" to 20'-0". The platform is nearly straight with two rows of columns measuring approximately 2'-8" from the platform edges. At the platform staircases, the columns measure 2'-8" from the platform edge and 0'-10" from the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 32" to 17" or less* which would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
Lefferts Boulevard

1.53 – MR 196 | Aqueduct Racetrack Station

Summary: *Aqueduct Racetrack Station is feasible for APGs only. Due to a lack of overhead structure at most of the platform, the full-height PSDs are not feasible. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power capacity could not be ascertained due to inaccessibility during survey. However, a lack of adequate existing power is not considered to be a determining factor of future feasibility.*

Description

The Aqueduct Racetrack Station is an on-grade station with one straight side platform **(see Figure 1)**. The platform structure is cast-in-place concrete. There are no columns throughout the platform. The platform width varies from 13'-8" to 43'-8". Ceiling heights measure no less than 7'-6" at the canopy. The canopy only covers 50% of the platform length.

Full Height PSDs: Full height PSDs are not feasible due to the lack of overhead structure at 50% of the station platform length. Full height PSDs require a top connection to brace against wind load.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting. At portions of platforms without roof, a custom-designed CCTV camera will need to be developed to be integrated into the APG housing.

Equipment Room

The equipment room can be located at the back of the station platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edge is original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would be required for the installation of an APG system.

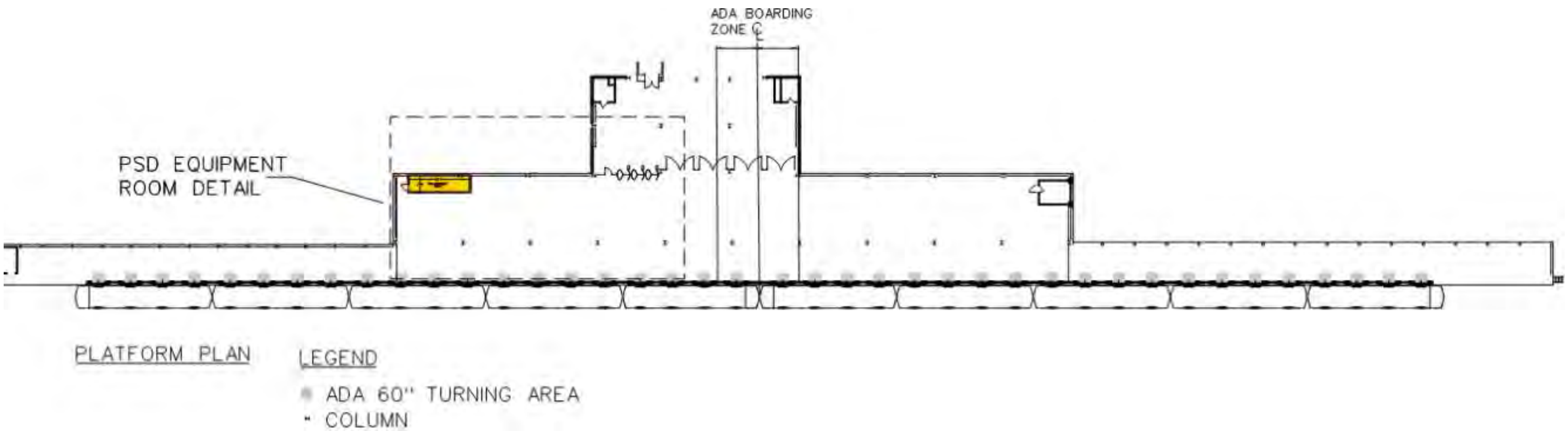

Figure 1 *– Overall plan*
Aqueduct Racetrack Station

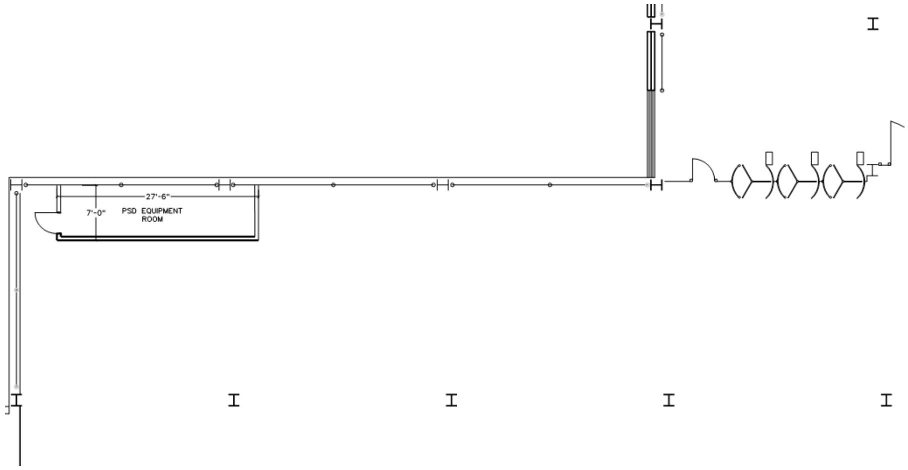

***Figure 1** – Equipment Room plan*
Aqueduct Racetrack Station

Platform obstructions within 5’ of edge:

Northbound Track:

- None

Lighting:

Existing lighting: At the canopy there are linear florescent fixtures mounted parallel to the platform edge. Beyond the canopy are individual point source fixtures mounted at the back of the platform. Depending on the specific APG design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

An analysis of adequate electrical power at this station could not be performed due to inaccessibility during survey. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Figure 3 *– General platform view*
Aqueduct Racetrack Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $22.3M to install APGs (See Appendix E).

1.54 – MR 197 | Aqueduct North Conduit Station

Summary: *Aqueduct North Conduit Station is feasible for APGs only. Due to a lack of overhead structure at most of the platform, the full-height PSDs are not feasible. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Aqueduct North Conduit Station is an on-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platform. The platform width is 11'-0" throughout. Ceiling heights measure no less than 7'-6" at the canopies. The canopy only covers 20% of the platform length.

Full Height PSDs: Full height PSDs are not feasible due to the lack of overhead structure at 80% of the station platform length. Full height PSDs require a top connection to brace against wind load.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting. At portions of platforms without roof, a custom-designed CCTV camera will need to be developed to be integrated into the APG housing.

Equipment Room

The equipment room can be located at the far north end of the northbound platform (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges are original to the station construction. From our limited visual inspection and our knowledge of the original construction, reconstruction of the platform edge would at a minimum be required for the installation of a APG system.

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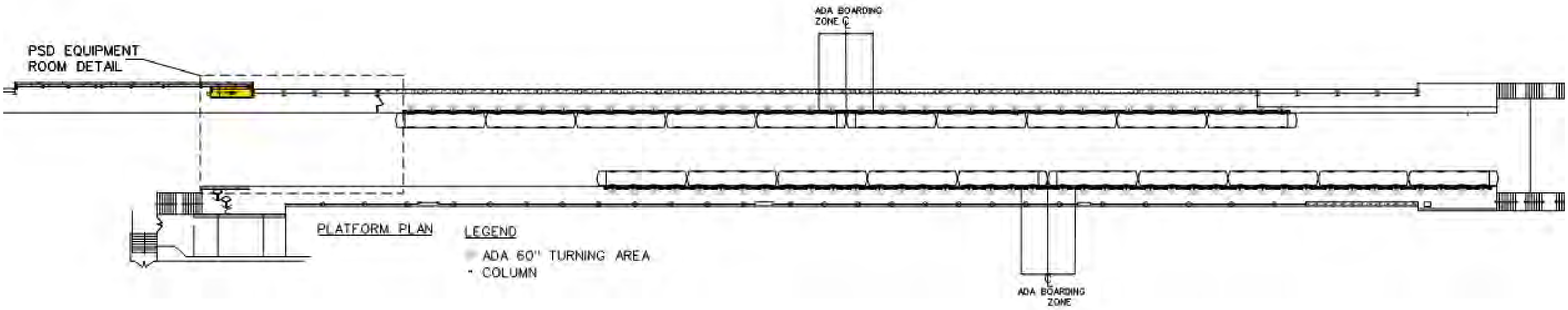

Figure 1 *– Overall plan*
Aqueduct North Conduit Station

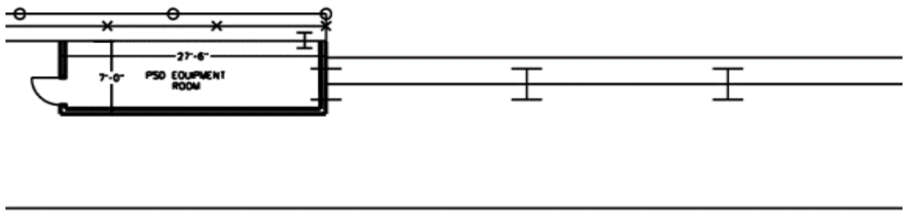

***Figure 1** – Equipment Room plan*
Aqueduct North Conduit Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: At the canopy there are linear florescent fixtures mounted parallel to the platform edge. Beyond the canopy are individual point source fixtures mounted at the back of the platform. Depending on the specific APG design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Aqueduct North Conduit Ave
Peak Demand Load from ConEd Report, (kW)	32.0
Apparent Power (kVA)	40.0
Station Peak Demand Load, Max Current, (A)	111.1
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	306
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	494
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Aqueduct North Conduit Ave
Peak Demand Load from ConEd Report, (kW)	0.8
Apparent Power (kVA)	1.0
Station Peak Demand Load, Max Current, (A)	2.8
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	198
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	603
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service.

Table 2. Power Capacity Analysis

***Figure 3** – General platform view*
Aqueduct North Conduit Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $35.6M to install APGs (See Appendix E).

1.55 – MR 198 | Howard Beach - Airtrain Station

Summary: *Howard Beach - Airtrain Station is feasible for APGs only. Due to a lack of overhead structure at much of the platform, the full-height PSDs are not feasible. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Howard Beach - Airtrain Station is an on-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platform. The platform widths are 11'-4" throughout. Ceiling heights measure no less than 7'-6" at the canopy. The canopy only covers 50% of the platform length.

Full Height PSDs: Full height PSDs are not feasible due to the lack of overhead structure at 50% of the station platform length. Full height PSDs require a top connection to brace against wind load.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting. At portions of platforms without roof, a custom-designed CCTV camera will need to be developed to be integrated into the APG housing.

Equipment Room

The equipment room can be located on grade beyond the north end of the northbound platform. (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

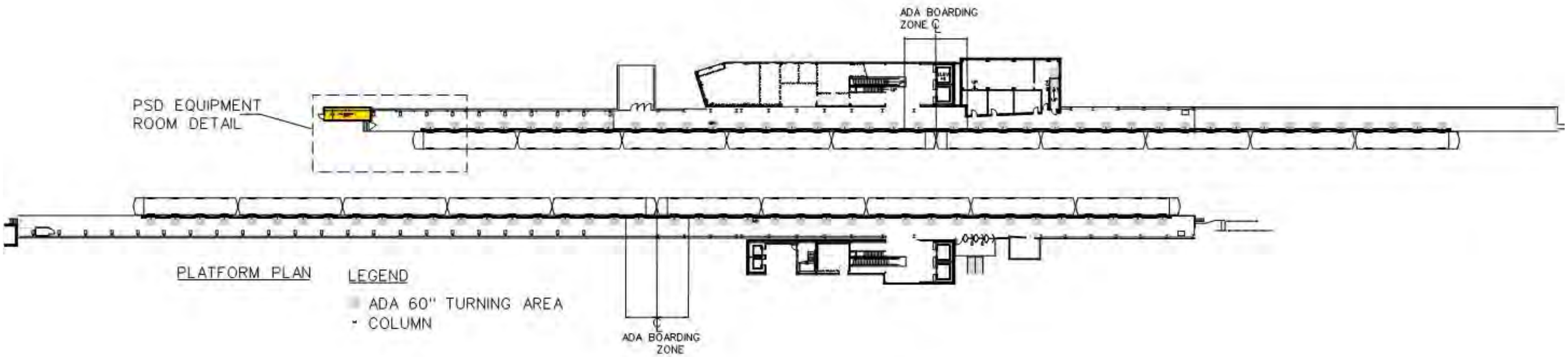

***Figure 1** – Overall plan*
Howard Beach Station

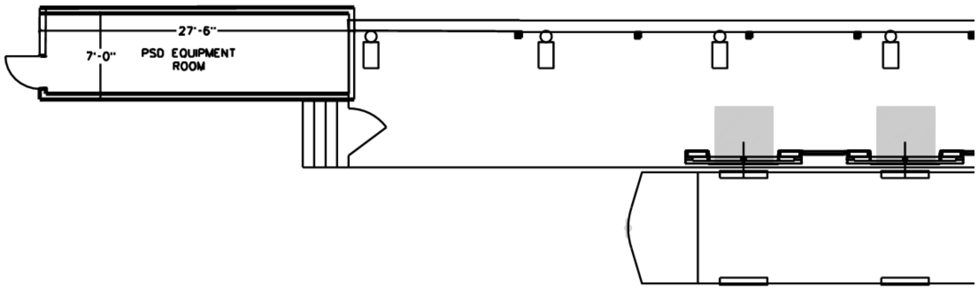

Figure 1 *– Equipment Room plan*
Howard Beach Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: At the canopy there are linear florescent fixtures mounted parallel to the platform edge. Beyond the canopy are individual point source fixtures mounted at the back of the platform. Depending on the specific APG design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Howard Beach Airtrain
Peak Demand Load from ConEd Report, (kW)	51.0
Apparent Power (kVA)	63.7
Station Peak Demand Load, Max Current, (A)	177.0
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	372
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	828
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 1200A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Howard Beach Airtrain
Peak Demand Load from ConEd Report, (kW)	48.0
Apparent Power (kVA)	60.0
Station Peak Demand Load, Max Current, (A)	166.7
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	361
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	839
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 1200A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service.

Table 2. Power Capacity Analysis

Figure 3 *– General platform view*
Howard Beach - Airtrain Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $33.1M to install APGs (See Appendix E).

1.56 – MR 199 | Broad Channel Station

Summary: *Broad Channel Station is feasible for APGs only. Due to a lack of overhead structure at much of the platform, the full-height PSDs are not feasible. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Broad Channel Station is an on-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platform. The platform widths are 12'-10" throughout. Ceiling heights measure no less than 7'-6" at the canopy. The canopy only covers 50% of the platform length.

Full Height PSDs: Full height PSDs are not feasible due to the lack of overhead structure at 50% of the station platform length. Full height PSDs require a top connection to brace against wind load.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting. At portions of platforms without roof, a custom-designed CCTV camera will need to be developed to be integrated into the APG housing.

Equipment Room

The equipment room can be located at the south end of the southbound platform (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

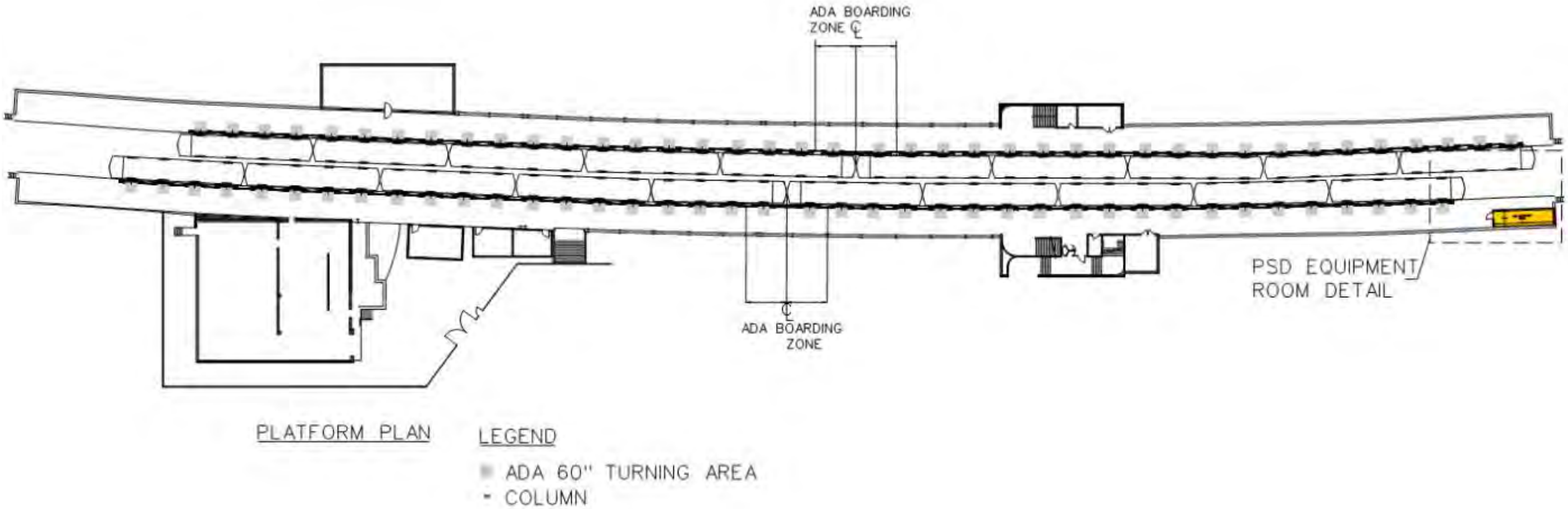

Figure 1 *– Overall plan*
Broad Channel Station

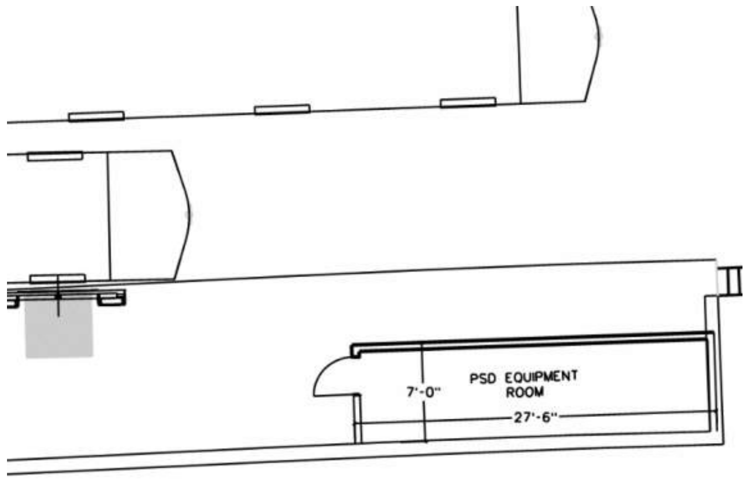

Figure 1 *– Equipment Room plan*
Broad Channel Station

Platform obstructions within 5’ of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: At the canopy there are linear florescent fixtures mounted parallel to the platform edge. Beyond the canopy are individual point source fixtures mounted at the back of the platform. Depending on the specific APG design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Broad Channel 199th St.
Peak Demand Load from ConEd Report, (kW)	60.5
Apparent Power (kVA)	75.6
Station Peak Demand Load, Max Current, (A)	210.0
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	405
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	795
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 1200A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Broad Channel 199th St.
Peak Demand Load from ConEd Report, (kW)	6.5
Apparent Power (kVA)	8.1
Station Peak Demand Load, Max Current, (A)	22.5
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	217
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	983
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 1200A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service.

Table 2. Power Capacity Analysis

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Figure 3 *– General platform view*
Broad Channel Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.6M to install APGs (See Appendix E).

1.57 – MR 200 | Beach 90th Street Station

Summary: *Beach 90th Street Station is feasible for APGs only. Due to a lack of overhead structure at much of the platform, the full-height PSDs are not feasible. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Beach 90th Street Station is an elevated station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platform. The platform widths are 11'-0" throughout. Ceiling heights measure no less than 7'-6" at the canopy. The canopy only covers 50% of the platform length.

Full Height PSDs: Full height PSDs are not feasible due to the lack of overhead structure at 50% of the station platform length. Full height PSDs require a top connection to brace against wind load.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting. At portions of platforms without roof, a custom-designed CCTV camera will need to be developed to be integrated into the APG housing.

Equipment Room

The equipment room can be located at the north end of the northbound platform (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

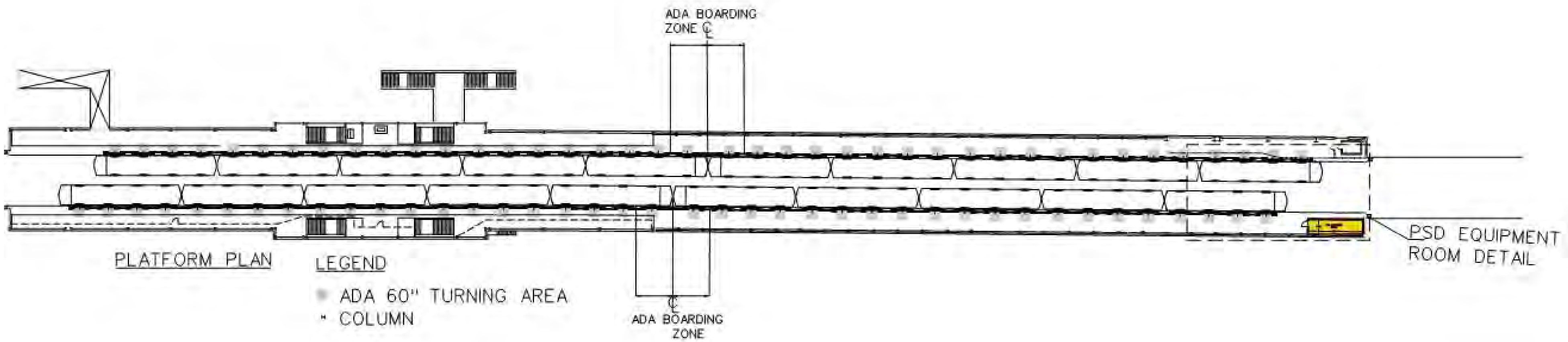

***Figure 1** – Overall plan*
Beach 90th Street Station

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'A' & 'C' Line Stations
(Beach 90th Street Station)

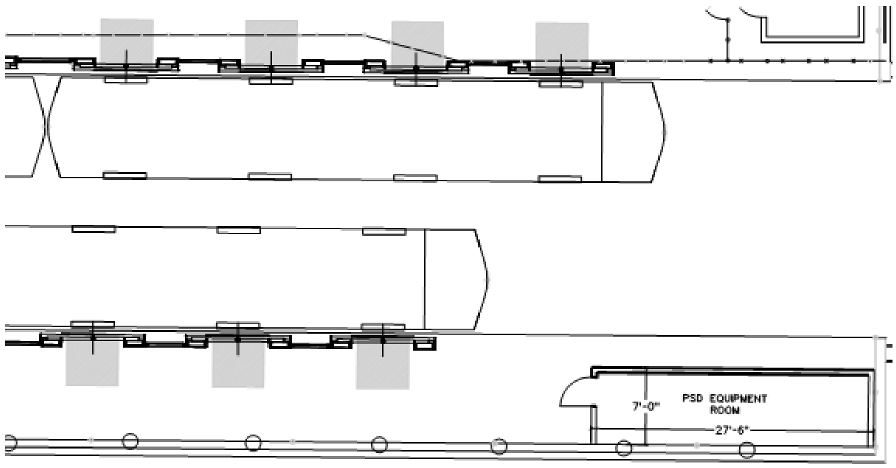

***Figure 2** – PSD Equipment Room Detail*
Beach 90th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: At the canopy there are linear florescent fixtures mounted parallel to the platform edge. Beyond the canopy are individual point source fixtures mounted at the back of the platform. Depending on the specific APG design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Beach 90th St Holland
Peak Demand Load from ConEd Report, (kW)	36.5
Apparent Power (kVA)	45.6
Station Peak Demand Load, Max Current, (A)	126.7
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	321
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	479
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Beach 90th St Holland
Peak Demand Load from ConEd Report, (kW)	9.5
Apparent Power (kVA)	11.9
Station Peak Demand Load, Max Current, (A)	33.0
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	228
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	572
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 2. Power Capacity Analysis

Figure 3 *– General platform view*
Beach 90th Street Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.4M to install APGs (See Appendix E).

1.58 – MR 201 | Beach 98th Street Station

Summary: *Beach 98th Street Station is feasible for APGs only. Due to a lack of overhead structure at much of the platform, the full-height PSDs are not feasible. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Beach 98th Street Station is an elevated station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platform. The platform widths are 10'-10" throughout. Ceiling heights measure no less than 7'-6" at the canopy. The canopy only covers 50% of the platform length.

Full Height PSDs: Full height PSDs are not feasible due to the lack of overhead structure at 50% of the station platform length. Full height PSDs require a top connection to brace against wind load.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting. At portions of platforms without roof, a custom-designed CCTV camera will need to be developed to be integrated into the APG housing.

Equipment Room

The equipment room can be located at the south end of the southbound platform (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

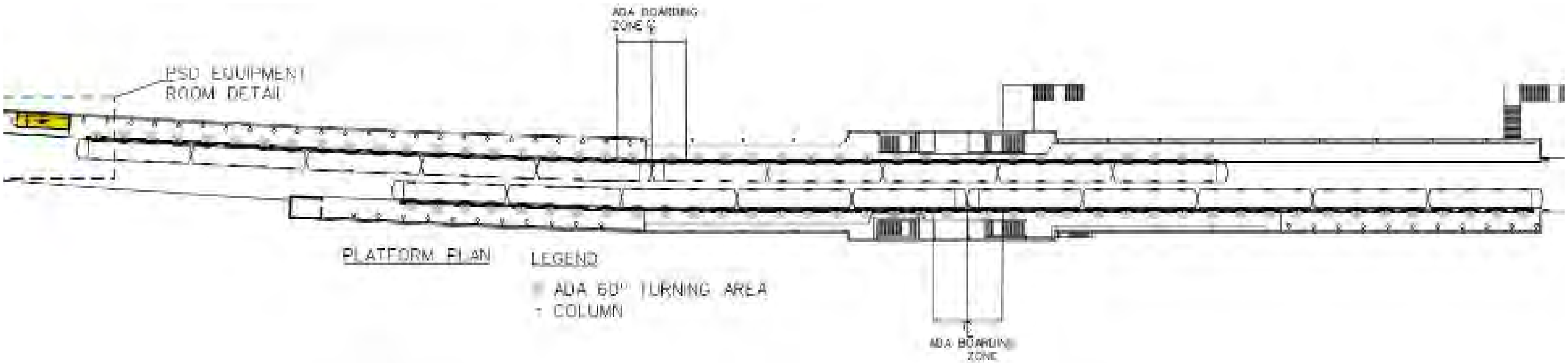

Figure 1 *– Overall plan*
Beach 98th Street Station

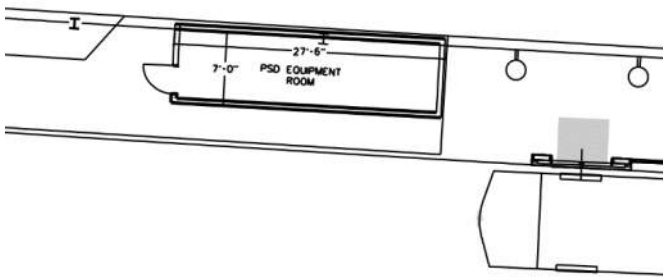

***Figure 2** – PSD Equipment Room Detail*
Beach 98th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: At the canopy there are linear florescent fixtures mounted parallel to the platform edge. Beyond the canopy are individual point source fixtures mounted at the back of the platform. Depending on the specific APG design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Beach 98th St Playland
Peak Demand Load from ConEd Report, (kW)	33.5
Apparent Power (kVA)	41.9
Station Peak Demand Load, Max Current, (A)	116.3
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	311
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	489
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Beach 98th St Playland
Peak Demand Load from ConEd Report, (kW)	29.0
Apparent Power (kVA)	36.3
Station Peak Demand Load, Max Current, (A)	100.7
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	295
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	505
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 2. Power Capacity Analysis

Figure 3 *– General platform view*
Beach 98th Street Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $35.9M to install APGs (See Appendix E).

1.59 – MR 202 | Beach 105th Street Station

Summary: *Beach 105th Street Station is feasible for APGs only. Due to a lack of overhead structure at much of the platform, the full-height PSDs are not feasible. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Beach 105th Street Station is an elevated station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platform. The platform widths are 10'-10" throughout. Ceiling heights measure no less than 7'-6" at the canopy. The canopy only covers 60% of the platform length.

Full Height PSDs: Full height PSDs are not feasible due to the lack of overhead structure at 40% of the station platform length. Full height PSDs require a top connection to brace against wind load.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting. At portions of platforms without roof, a custom-designed CCTV camera will need to be developed to be integrated into the APG housing.

Equipment Room

The equipment room can be located at the center of the northbound platform (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'A' & 'C' Line Stations
(Beach 105th Street Station)

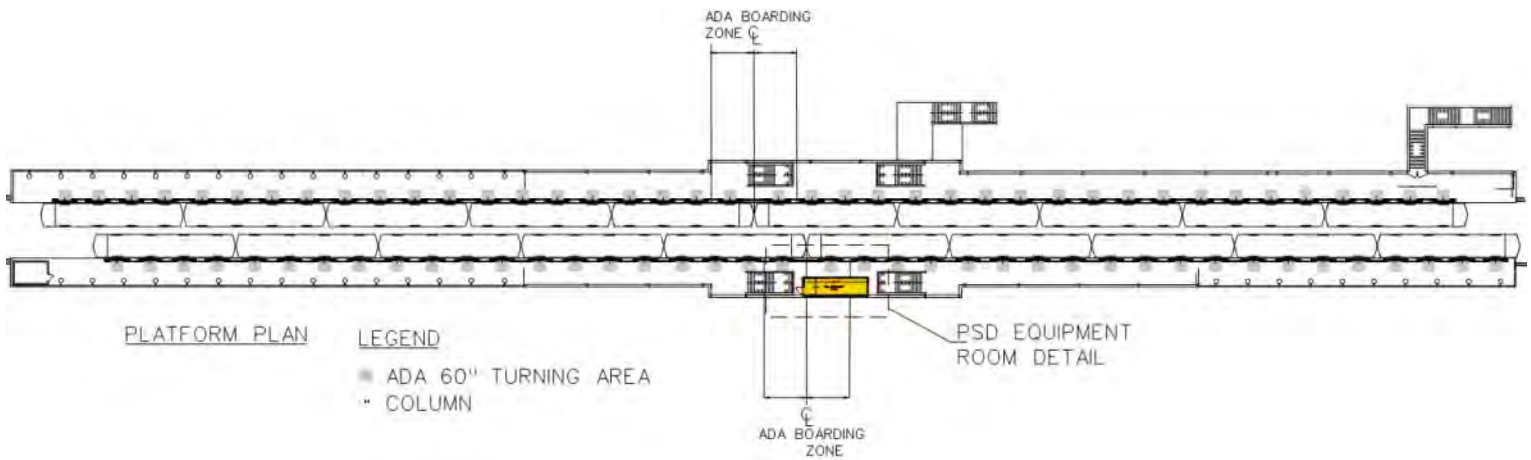

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***Figure 1** – Overall plan*
Beach 105th Street Station

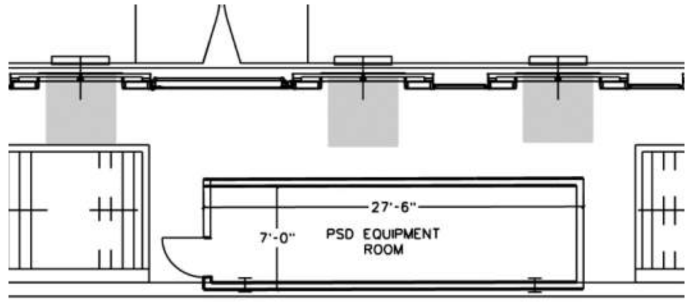

***Figure 2** – PSD Equipment Room Detail*
Beach 105th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: At the canopy there are linear florescent fixtures mounted parallel to the platform edge. Beyond the canopy are individual point source fixtures mounted at the back of the platform. Depending on the specific APG design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

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Station Power Capacity Analysis (Normal Service)

Station Name	Beach 105th St. Seaside
Peak Demand Load from ConEd Report, (kW)	38.5
Apparent Power (kVA)	48.1
Station Peak Demand Load, Max Current, (A)	133.7
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	328
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	472
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Beach 105th St. Seaside
Peak Demand Load from ConEd Report, (kW)	13.5
Apparent Power (kVA)	16.9
Station Peak Demand Load, Max Current, (A)	48.9
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	241
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	559
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 2. Power Capacity Analysis

Figure 3 *– General platform view*
Beach 105th Street Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.7M to install APGs (See Appendix E).

1.60 – MR 203 | Rockaway Park Station

Summary: *Rockaway Park Station is feasible for APGs only. Due to a lack of overhead structure at much of the platform, the full-height PSDs are not feasible. The Rockaway Park Shuttle Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Rockaway Park Station is an elevated station with one straight center / island platform **(see Figure 1)**. The platform structure is cast-in-place concrete. There are two rows of columns at the canopy at 5'-6" from the platform edge. The platform width is 27'-8" throughout. Ceiling heights measure no less than 7'-6" at the canopy. The canopy only covers 50% of the platform length.

Full Height PSDs: Full height PSDs are not feasible due to the lack of overhead structure at 50% of the station platform length. Full height PSDs require a top connection to brace against wind load.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting. At portions of platforms without roof, a custom-designed CCTV camera will need to be developed to be integrated into the APG housing.

Equipment Room

The equipment room can be located at the north end of the platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

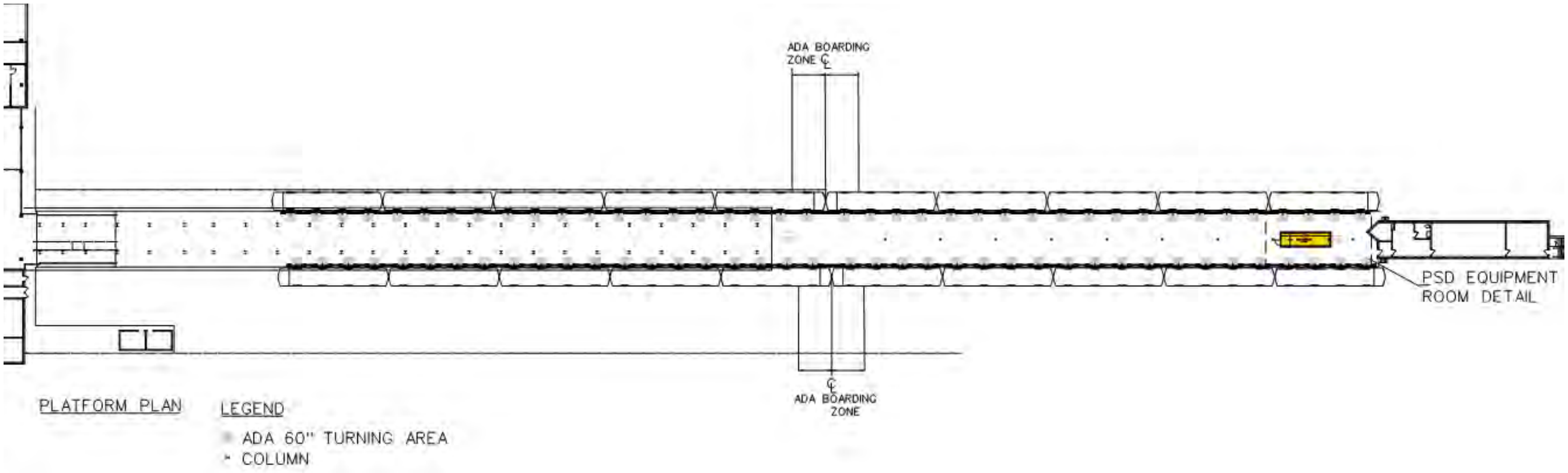

Figure 1 *– Overall plan*
Rockaway Park Station

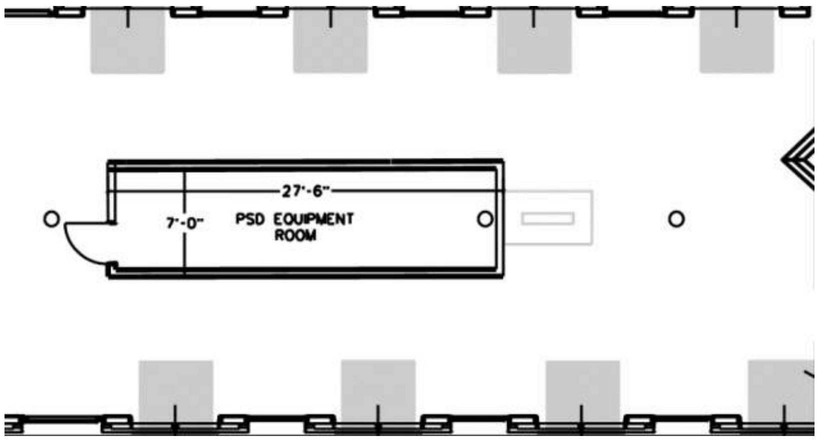

***Figure 2** – PSD Equipment Room Detail*
Rockaway Park Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: At the canopy there are linear florescent fixtures mounted parallel to the platform edge. Beyond the canopy are individual point source fixtures mounted at the center of the platform. Depending on the specific APG design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Rockaway Park Beach 116th St.
Peak Demand Load from ConEd Report, (kW)	15.0
Apparent Power (kVA)	18.8
Station Peak Demand Load, Max Current, (A)	31.3
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	226
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	974
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 1200A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Rockaway Park Beach 116th St.
Peak Demand Load from ConEd Report, (kW)	66.5
Apparent Power (kVA)	83.1
Station Peak Demand Load, Max Current, (A)	138.5
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	333
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	867
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 1200A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 2. Power Capacity Analysis

***Figure 3** – General platform view*
Rockaway Park Station

Historic Restrictions:
The Rockaway Park station is a historically designated property. As such, design will require review by the New York State Historic Preservation Office.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $33.8M to install APGs (See Appendix E).

1.61 – MR 204 | Beach 67th Street Station

Summary: *Beach 67th Street Station is feasible for APGs only. Due to a lack of overhead structure at much of the platform, the full-height PSDs are not feasible. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Beach 67th Street Station is an elevated station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platform. The platform widths are 10'-10" throughout. Ceiling heights measure no less than 7'-6" at the canopy. The canopy only covers 60% of the platform length.

Full Height PSDs: Full height PSDs are not feasible due to the lack of overhead structure at 40% of the station platform length. Full height PSDs require a top connection to brace against wind load.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting. At portions of platforms without roof, a custom-designed CCTV camera will need to be developed to be integrated into the APG housing.

Equipment Room

The equipment room can be located at the center of the southbound platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

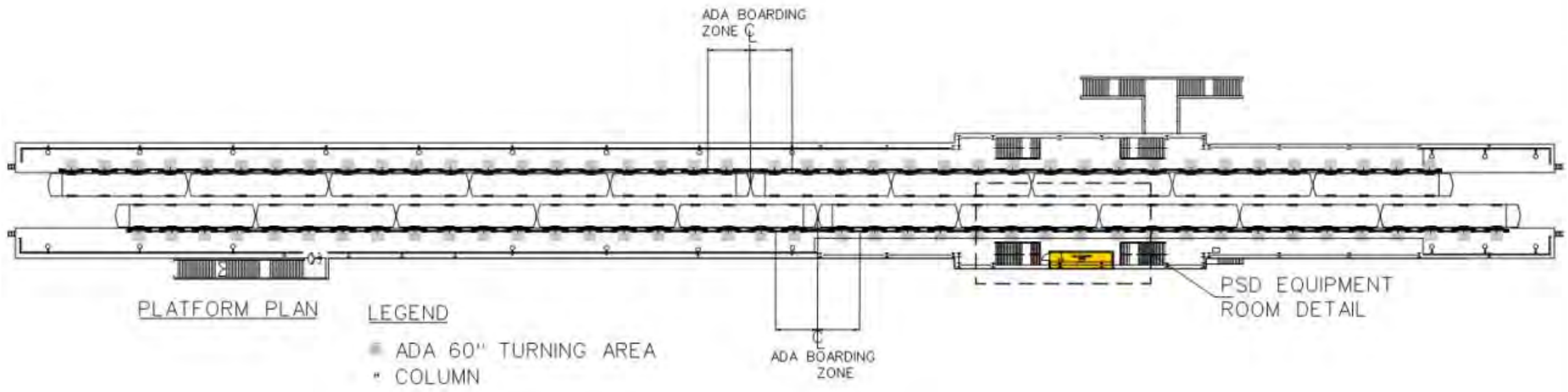

Figure 1 *– Overall plan*
Beach 67th Street Station

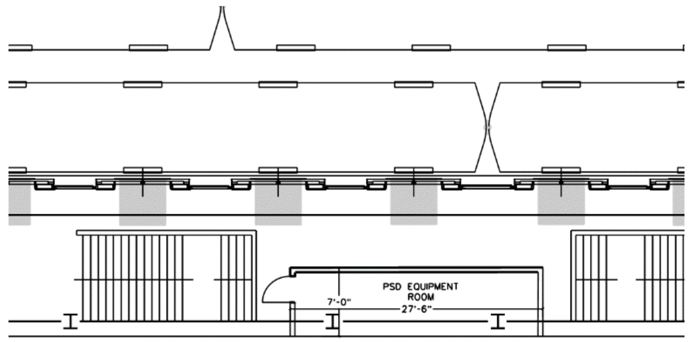

***Figure 2** – PSD Equipment Room Detail*
Beach 67th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: At the canopy there are linear florescent fixtures mounted parallel to the platform edge. Beyond the canopy are individual point source fixtures mounted at the back of the platform. Depending on the specific APG design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Beach 67th St. Gaston Ave
Peak Demand Load from ConEd Report, (kW)	33.0
Apparent Power (kVA)	41.3
Station Peak Demand Load, Max Current, (A)	114.6
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	309
Station Service Power Capacity, (A)	400
Service Spare Capacity, (A)	91
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 400A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Beach 67th St. Gaston Ave
Peak Demand Load from ConEd Report, (kW)	7.0
Apparent Power (kVA)	8.8
Station Peak Demand Load, Max Current, (A)	24.3
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	219
Station Service Power Capacity, (A)	400
Service Spare Capacity, (A)	181
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 400A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 2. Power Capacity Analysis

Figure 3 *– General platform view*
Beach 67th Street Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.1M to install APGs (See Appendix E).

1.62 – MR 205 | Beach 60th Street Station

Summary: *Beach 60th Street Station is feasible for APGs only. Due to a lack of overhead structure at much of the platform, the full-height PSDs are not feasible. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Beach 60th Street Station is an elevated station with two nearly straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platform. The platform widths are 10'-8" throughout. Ceiling heights measure no less than 7'-6" at the canopy. The canopy only covers 50% of the platform length.

Full Height PSDs: Full height PSDs are not feasible due to the lack of overhead structure at 50% of the station platform length. Full height PSDs require a top connection to brace against wind load.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting. At portions of platforms without roof, a custom-designed CCTV camera will need to be developed to be integrated into the APG housing.

Equipment Room

The equipment room can be located at the south end of the southbound platform (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are nearly tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for ‘A’ & ‘C’ Line Stations

(Beach 60th Street Station)

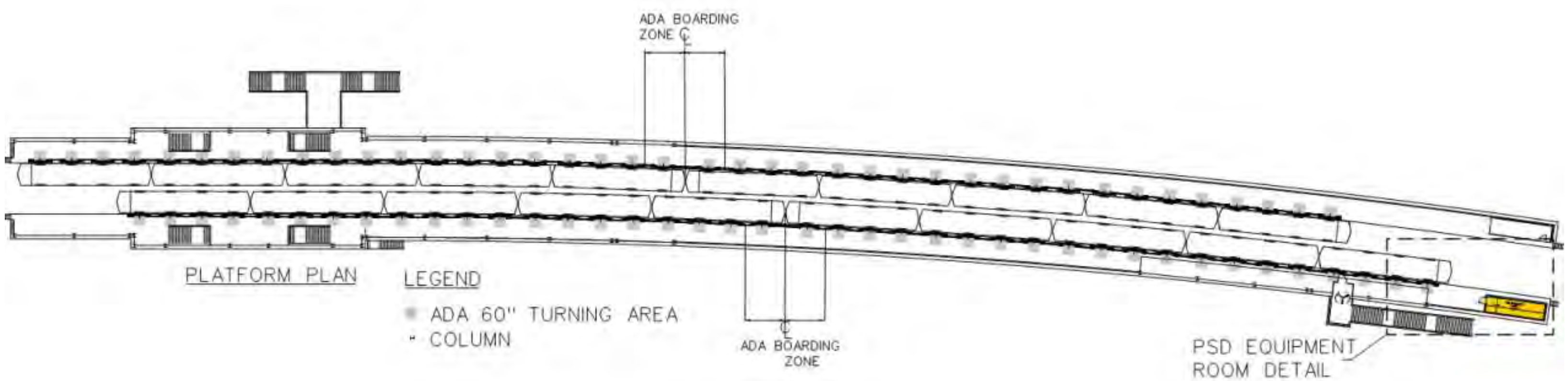

Figure 1 *– Overall plan*
Beach 60th Street Station

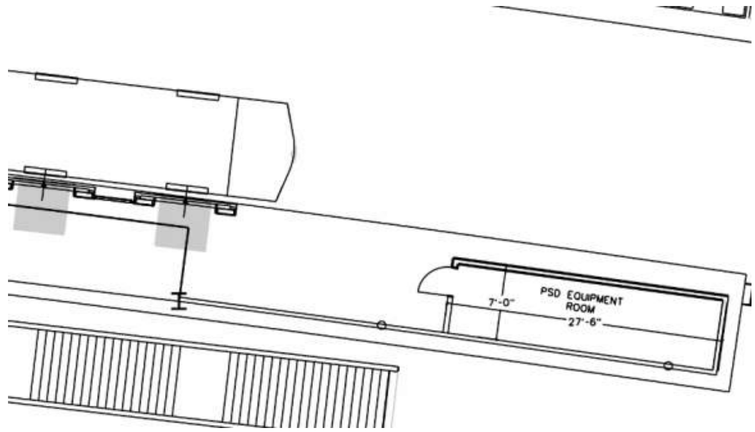

***Figure 2** – PSD Equipment Room Detail*
Beach 60th Street Station

Platform obstructions within 5’ of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: At the canopy there are linear florescent fixtures mounted parallel to the platform edge. Beyond the canopy are individual point source fixtures mounted at the back of the platform. Depending on the specific APG design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Beach 60th St. Staiton Ave.
Peak Demand Load from ConEd Report, (kW)	36.0
Apparent Power (kVA)	45.0
Station Peak Demand Load, Max Current, (A)	125.0
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	320
Station Service Power Capacity, (A)	400
Service Spare Capacity, (A)	80
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 400A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Beach 60th St. Staiton Ave.
Peak Demand Load from ConEd Report, (kW)	25.0
Apparent Power (kVA)	31.3
Station Peak Demand Load, Max Current, (A)	86.8
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	281
Station Service Power Capacity, (A)	400
Service Spare Capacity, (A)	119
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 400A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 2. Power Capacity Analysis

***Figure 3** – General platform view*
Beach 60th Street Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.7M to install APGs (See Appendix E).

1.63 – MR 206 | Beach 44th Street Station

Summary: *Beach 44th Street Station is feasible for APGs only. Due to a lack of overhead structure at much of the platform, the full-height PSDs are not feasible. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Beach 44th Street Station is an elevated station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platform. The platform widths are 11'-0" throughout. Ceiling heights measure no less than 7'-6" at the canopy. The canopy only covers 50% of the platform length.

Full Height PSDs: Full height PSDs are not feasible due to the lack of overhead structure at 50% of the station platform length. Full height PSDs require a top connection to brace against wind load.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting. At portions of platforms without roof, a custom-designed CCTV camera will need to be developed to be integrated into the APG housing.

Equipment Room

The equipment room can be located at the center of the southbound platform (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

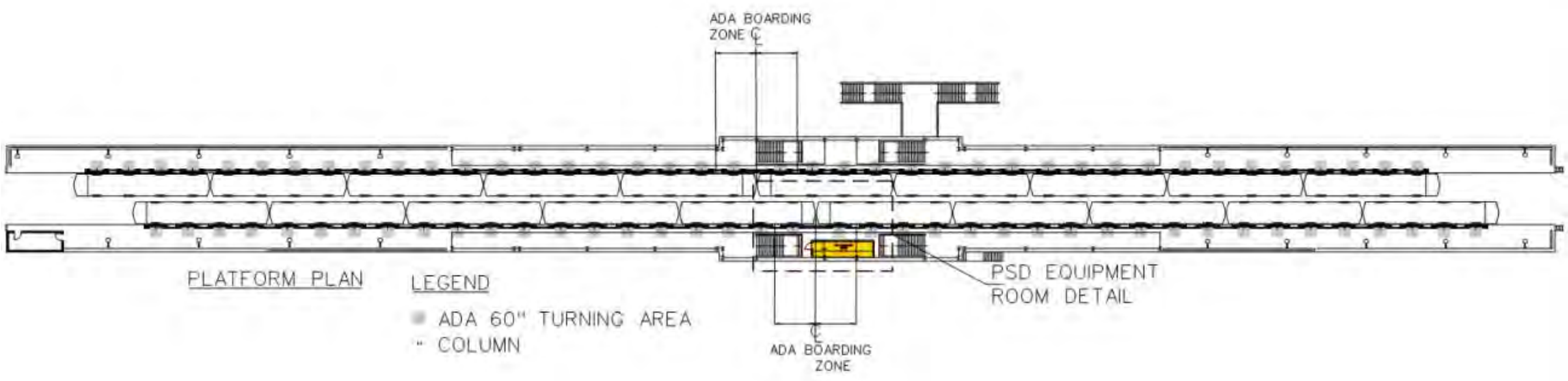

Figure 1 *– Overall plan*
Beach 44th Street Station

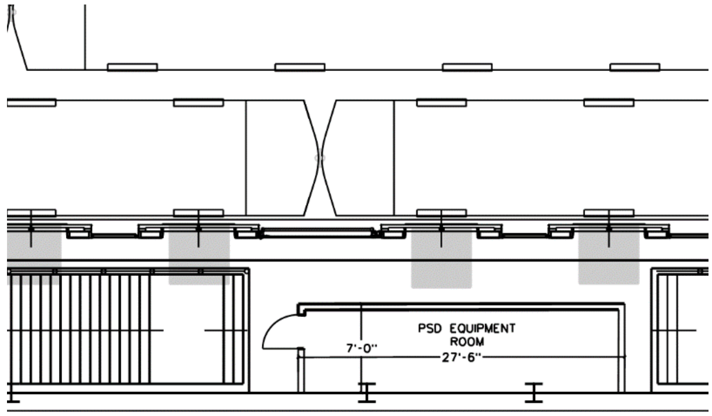

***Figure 2** – PSD Equipment Room Detail*
Beach 44th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: At the canopy there are linear florescent fixtures mounted parallel to the platform edge. Beyond the canopy are individual point source fixtures mounted at the back of the platform. Depending on the specific APG design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Beach 44th St. Frank Ave.
Peak Demand Load from ConEd Report, (kW)	37.0
Apparent Power (kVA)	46.3
Station Peak Demand Load, Max Current, (A)	128.5
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	323
Station Service Power Capacity, (A)	400
Service Spare Capacity, (A)	77
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 400A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Beach 44th St. Frank Ave.
Peak Demand Load from ConEd Report, (kW)	7.0
Apparent Power (kVA)	8.8
Station Peak Demand Load, Max Current, (A)	24.3
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	219
Station Service Power Capacity, (A)	400
Service Spare Capacity, (A)	181
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 400A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 2. Power Capacity Analysis

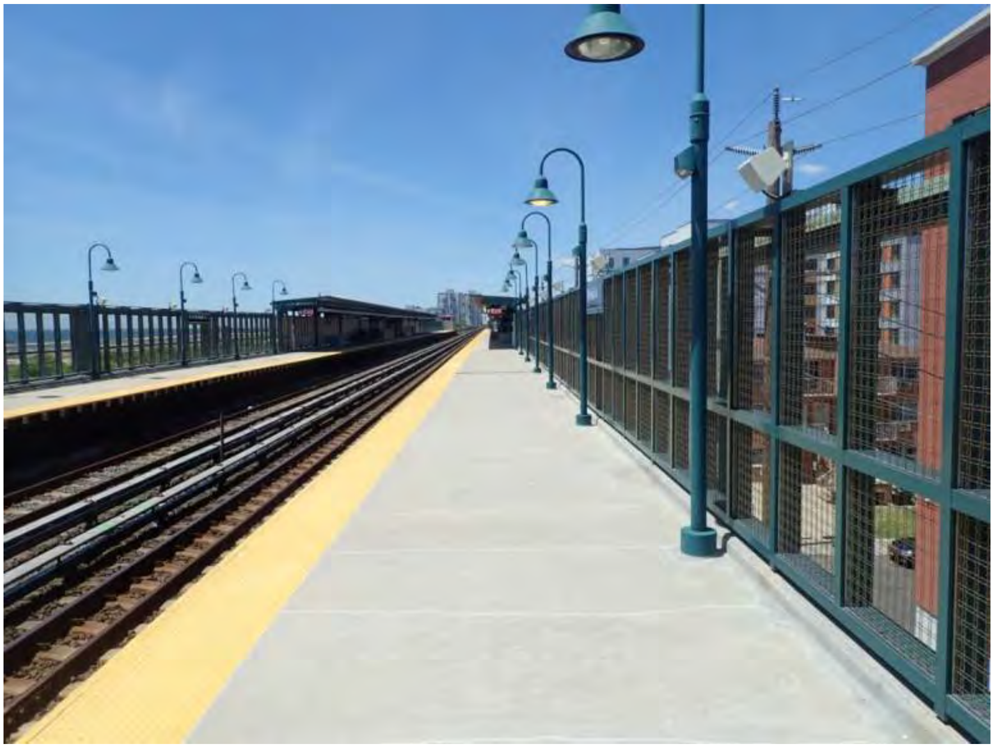

***Figure 3** – General platform view*
Beach 44th Street Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.5M to install APGs (See Appendix E).

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1.64 – MR 207 | Beach 36th Street Station

Summary: *Beach 36th Street Station is feasible for APGs only. Due to a lack of overhead structure at much of the platform, the full-height PSDs are not feasible. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Beach 36th Street Station is an elevated station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platform. The platform widths are 10'-10" throughout. Ceiling heights measure no less than 7'-6" at the canopy. The canopy only covers 50% of the platform length.

Full Height PSDs: Full height PSDs are not feasible due to the lack of overhead structure at 50% of the station platform length. Full height PSDs require a top connection to brace against wind load.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting. At portions of platforms without roof, a custom-designed CCTV camera will need to be developed to be integrated into the APG housing.

Equipment Room

The equipment room can be located at the center of the southbound platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

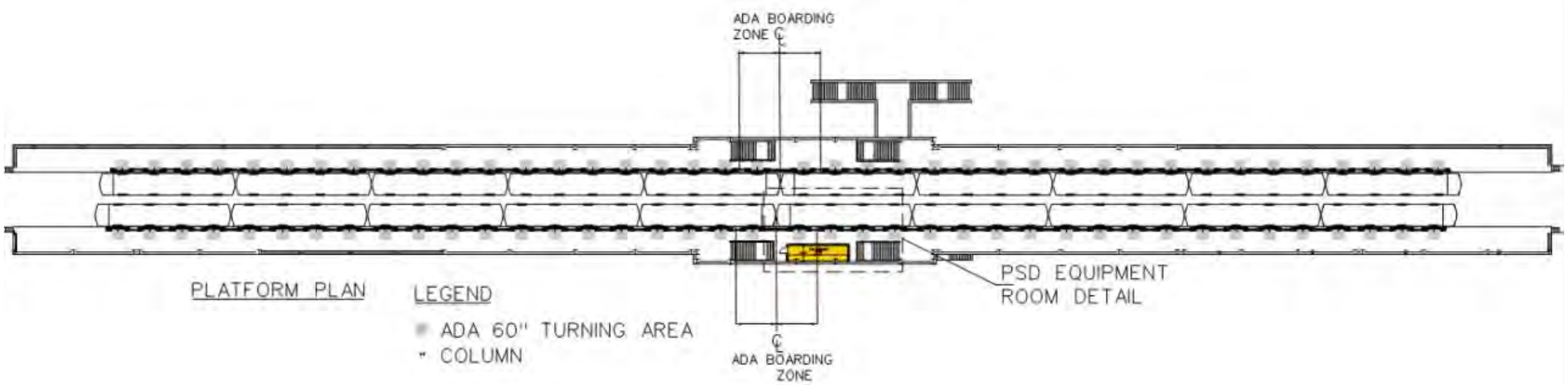

***Figure 1** – Overall plan*
Beach 36th Street Station

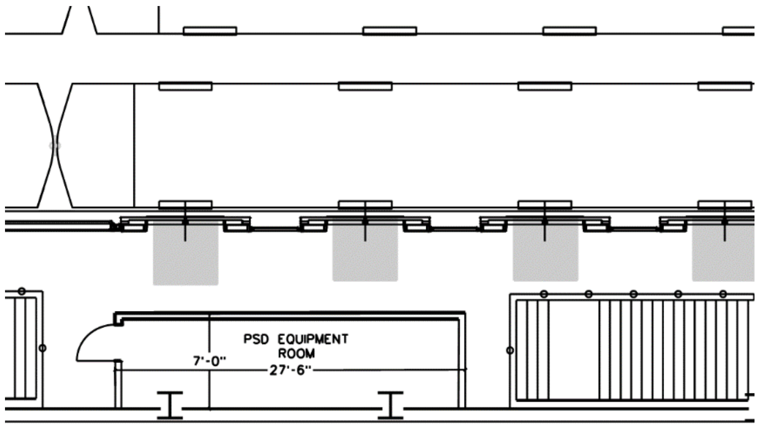

Figure 2 *– PSD Equipment Room Detail*
Beach 36th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: At the canopy there are linear florescent fixtures mounted parallel to the platform edge. Beyond the canopy are individual point source fixtures mounted at the back of the platform. Depending on the specific APG design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Beach 36th St. Edgemere
Peak Demand Load from ConEd Report, (kW)	36.0
Apparent Power (kVA)	45.0
Station Peak Demand Load, Max Current, (A)	125.0
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	320
Station Service Power Capacity, (A)	400
Service Spare Capacity, (A)	80
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 400A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Beach 36th St. Edgemere
Peak Demand Load from ConEd Report, (kW)	29.5
Apparent Power (kVA)	36.9
Station Peak Demand Load, Max Current, (A)	102.4
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	297
Station Service Power Capacity, (A)	400
Service Spare Capacity, (A)	103
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 400A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 2. Power Capacity Analysis

Figure 3 *– General platform view*
Beach 36th Street Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.5M to install APGs (See Appendix E).

1.65 – MR 208 | Beach 25th Street Station

Summary: *Beach 25th Street Station is feasible for APGs only. Due to a lack of overhead structure at much of the platform, the full-height PSDs are not feasible. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Beach 25th Street Station is an elevated station with two nearly straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns throughout the platform. The platform widths are 11'-0" throughout. Ceiling heights measure no less than 7'-6" at the canopy. The canopy only covers 50% of the platform length.

Full Height PSDs: Full height PSDs are not feasible due to the lack of overhead structure at 50% of the station platform length. Full height PSDs require a top connection to brace against wind load.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting. At portions of platforms without roof, a custom-designed CCTV camera will need to be developed to be integrated into the APG housing.

Equipment Room

The equipment room can be located at the center of the southbound platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are nearly tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

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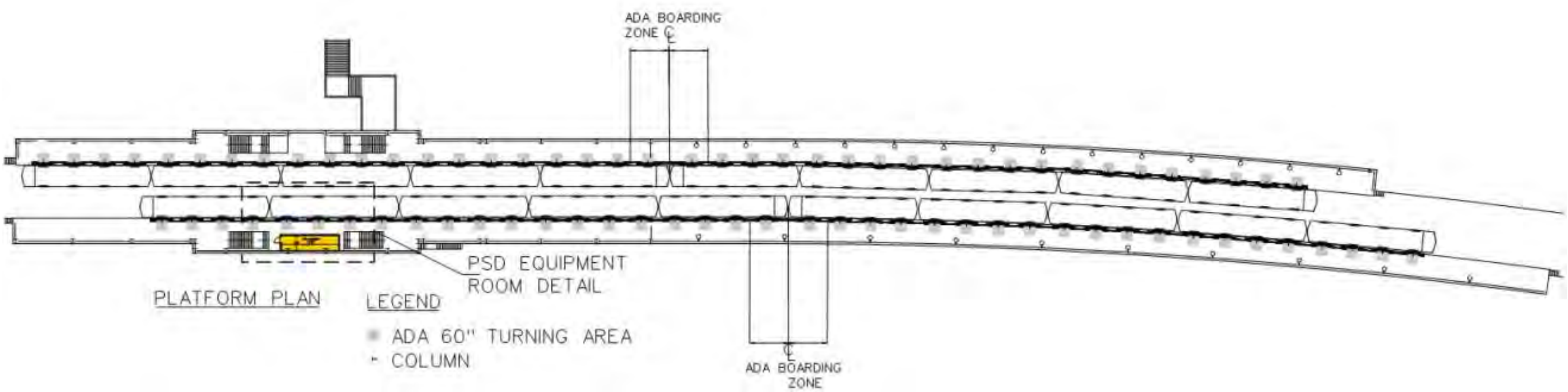

Figure 1 – Overall plan
Beach 25th Street Station

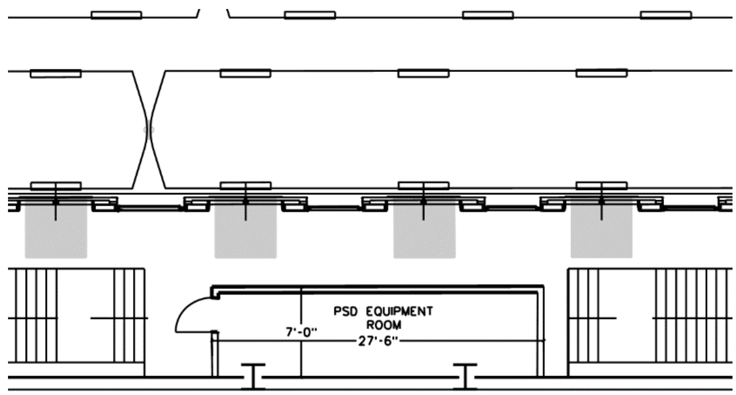

Figure 2 *– PSD Equipment Room Detail*
Beach 25th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: At the canopy there are linear florescent fixtures mounted parallel to the platform edge. Beyond the canopy are individual point source fixtures mounted at the back of the platform. Depending on the specific APG design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Beach 25th St. Wavecrest
Peak Demand Load from ConEd Report, (kW)	35.0
Apparent Power (kVA)	43.8
Station Peak Demand Load, Max Current, (A)	121.5
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	316
Station Service Power Capacity, (A)	400
Service Spare Capacity, (A)	84
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 400A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Beach 25th St. Wavecrest
Peak Demand Load from ConEd Report, (kW)	8.0
Apparent Power (kVA)	10.0
Station Peak Demand Load, Max Current, (A)	27.8
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	222
Station Service Power Capacity, (A)	400
Service Spare Capacity, (A)	178
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 400A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 2. Power Capacity Analysis

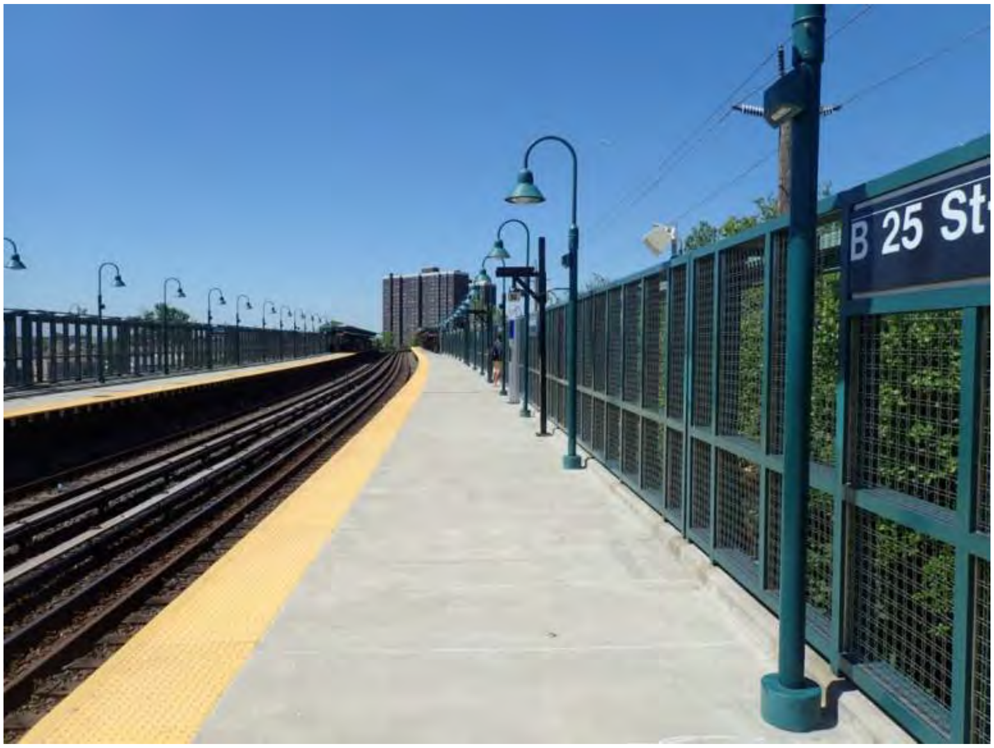

***Figure 3** – General platform view*
Beach 25th Street Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $33.5M to install APGs (See Appendix E).

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1.66 – MR 209 | Far Rockaway / Mott Avenue Station

Summary: *Far Rockaway / Mott Avenue Station is feasible for APGs only. Due to a lack of overhead structure at much of the platform, the full-height PSDs are not feasible. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Far Rockaway / Mott Avenue Station is an elevated station with one straight center / island platform **(see Figure 1)**. The platform structure is cast-in-place concrete. There are two rows columns at the canopy, at 4'-4" from the platform edge. The platform width is 24'-6" throughout. Ceiling heights measure no less than 7'-6" at the canopy. The canopy only covers 60% of the platform length.

Full Height PSDs: Full height PSDs are not feasible due to the lack of overhead structure at 40% of the station platform length. Full height PSDs require a top connection to brace against wind load.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting. At portions of platforms without roof, a custom-designed CCTV camera will need to be developed to be integrated into the APG housing.

Equipment Room

The equipment room can be located at the center of the platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

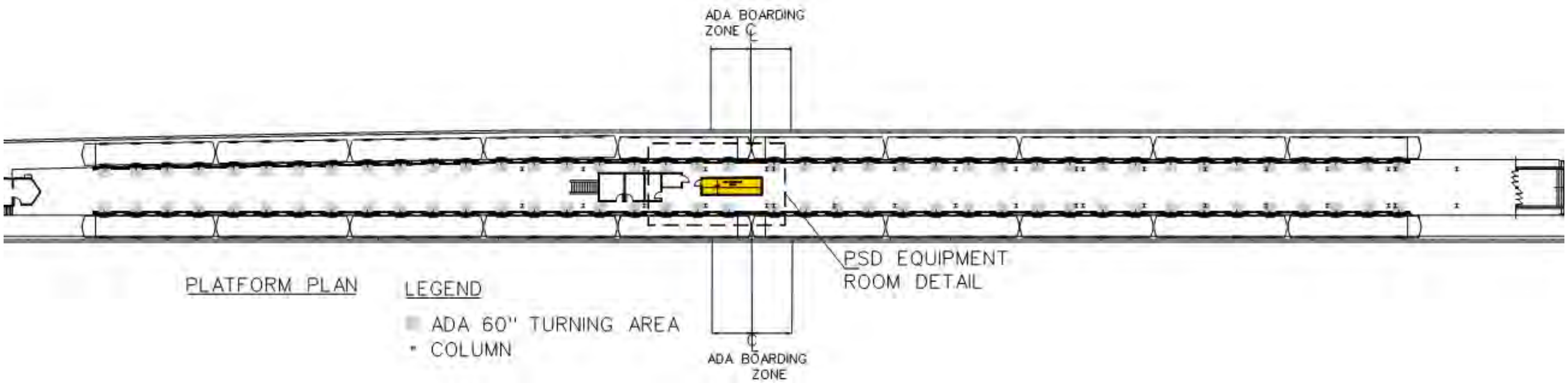


Figure 1 *– Overall plan*
Far Rockaway / Mott Ave Station

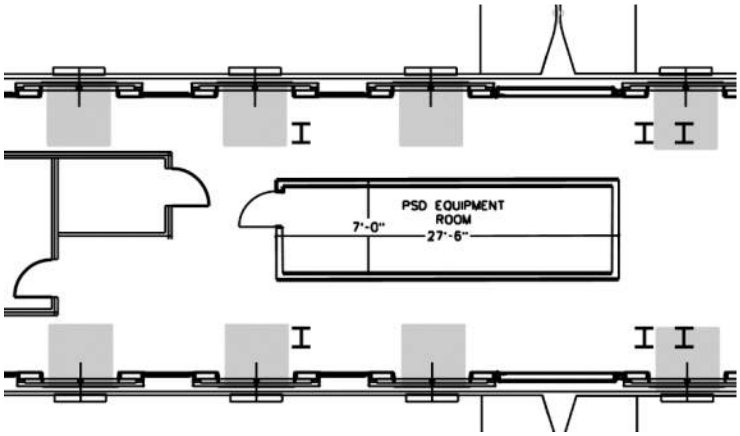


Figure 2 *– PSD Equipment Room Detail*
Far Rockaway / Mott Ave Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions

Lighting:

Existing lighting: At the canopy there are linear florescent fixtures mounted parallel to the platform edge. Beyond the canopy are individual point source fixtures mounted at the center of the platform. Depending on the specific APG design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Far Rockaway / Mott Ave.
Peak Demand Load from ConEd Report, (kW)	36.5
Apparent Power (kVA)	45.6
Station Peak Demand Load, Max Current, (A)	126.7
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	321
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	479
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Far Rockaway / Mott Ave.
Peak Demand Load from ConEd Report, (kW)	101.5
Apparent Power (kVA)	126.9
Station Peak Demand Load, Max Current, (A)	352.4
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	547
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	253
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Utility is LIPA.

Table 2. Power Capacity Analysis

***Figure 3** – General platform view*
Far Rockaway / Mott Avenue Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.4M to install APGs (See Appendix E).

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*
>
> - *a. Column location in relation to the platform edge*
> - *b. Platform edge clearance adjacent to stairs and other impediments*
> - *c. Impacts to ADA path of travel and boarding areas*
> - *d. Conflicts of PSD/APG/RPSDs with Signals cables*
> - *e. Sufficient platform width*
> - *f. Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*
>
> - *a. Structural capacity of platforms to accept PSD/APG/RPSDs*
> - *b. Feasibility & location for PSD/APG/RPSDs equipment room*
> - *c. Confirmation of adequate power for PSD/APG/RPSDs*
> - *d. Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> - *e. Determination of communications requirements, availability and cost*
> - *f. Determination of gap detection and entrapment avoidance technology requirements*
> - *g. Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
    - Double the amount of motors as PSDs (each motor operating a single leaf).
    - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
    - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
    - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY. Status of doors will be provided to crew via indicator lights, with no automated propulsion cutout.

If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

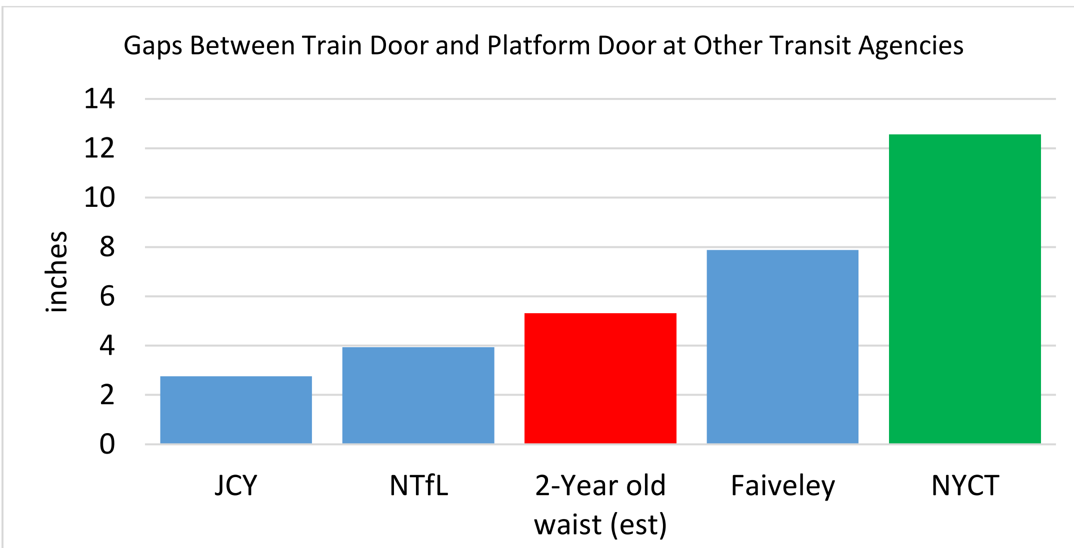


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

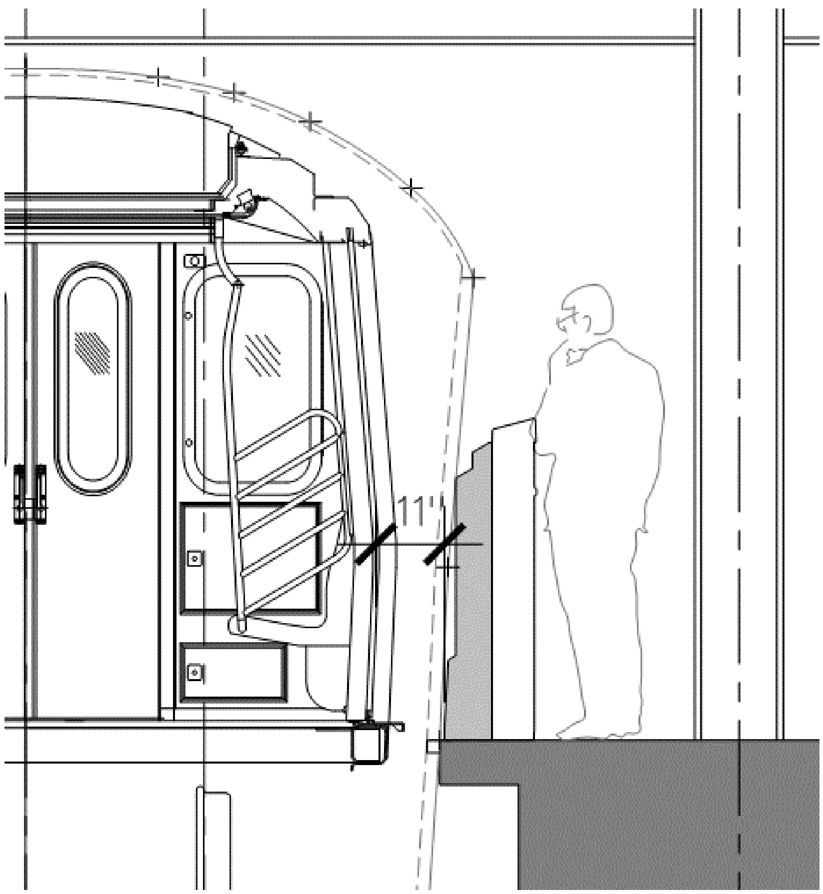


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber “bumpers” on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6” into the line equipment envelope. This would leave a 5” gap between the platform and car doors allowing approximately 2” of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5" by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor's window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor's window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **<u>bold/underline</u>**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	**PSD System 1**	**PSD System 2**	**PSD System 3**
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are "existing" as defined by code. All the rolling stock is also to be considered "existing" under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60" radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36" of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

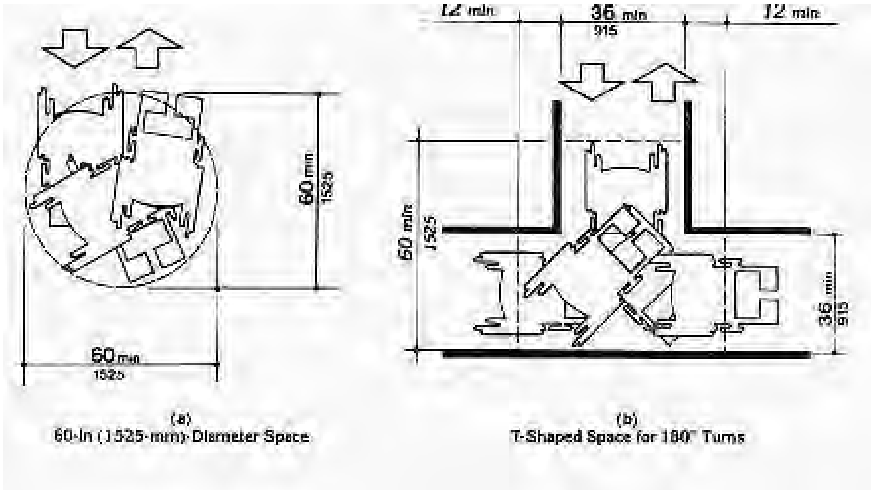
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*

The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

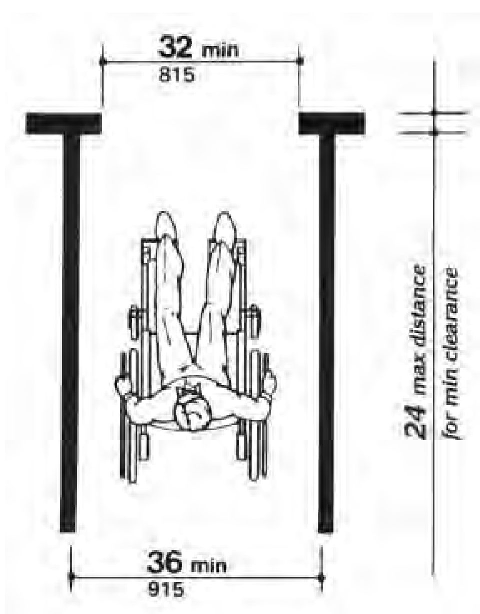


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

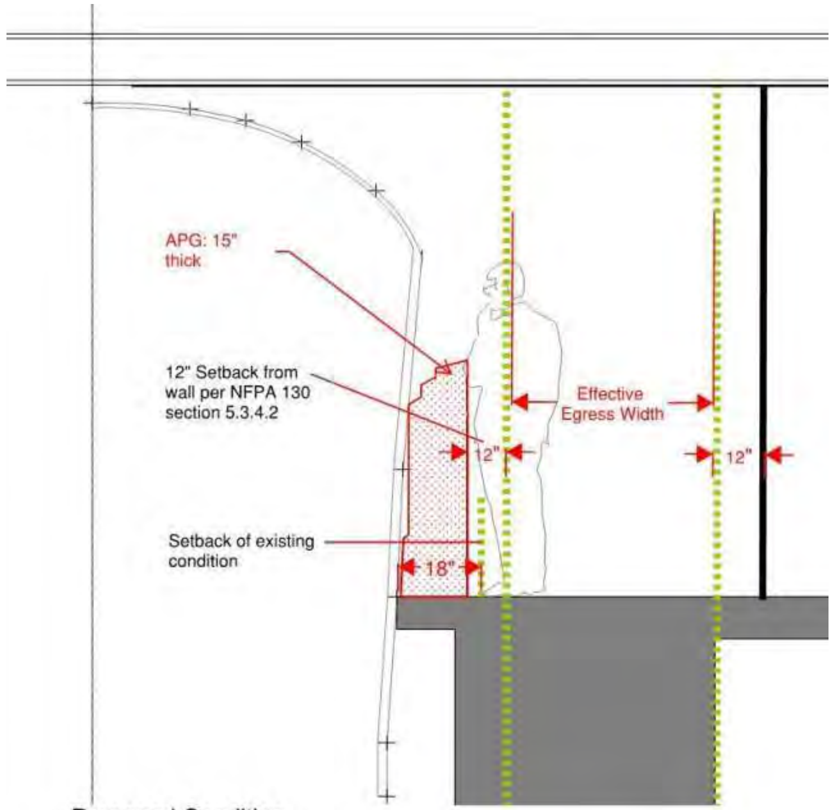
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15" of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

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Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

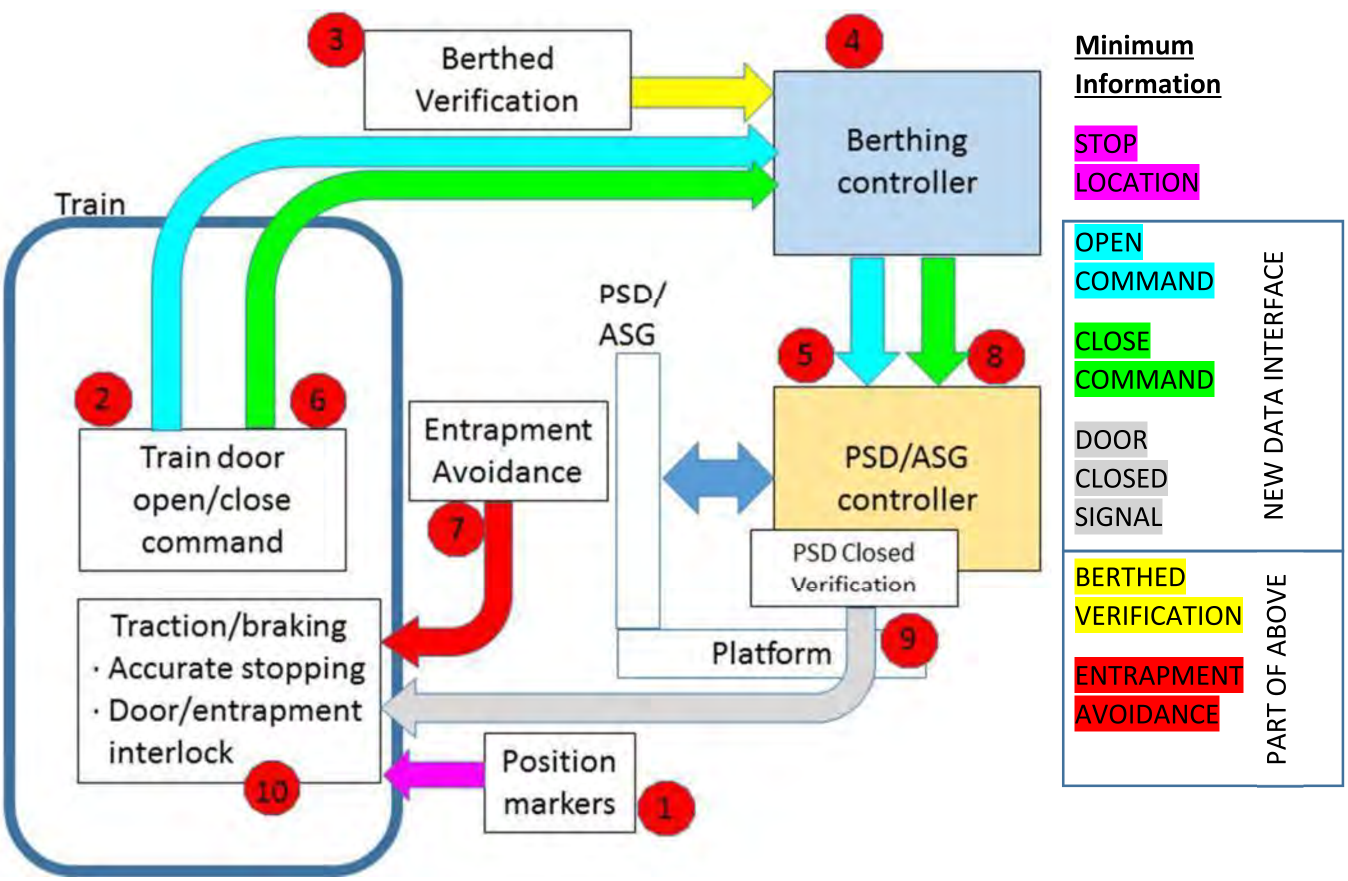
A. Accurate Stopping
  1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
  2. Transmit OPEN COMMAND from the train to the wayside.
  3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
  4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
  5. Transmit OPEN COMMAND to PSD/ASG controller.

C. Dwell during passenger boarding/alighting

D. Close doors
  6. Transit CLOSE COMMAND from train to wayside.
  8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
  7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
  9. Transmit DOOR CLOSED SIGNAL from wayside to train.
  10. Accelerate from station when safe to do so.



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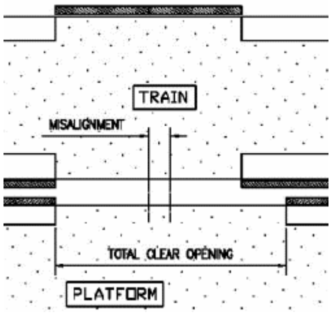
Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5" clear opening, a design for NY should meet the ADA Accessibility Guideline of 36".

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a 'distance totem' which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy's COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

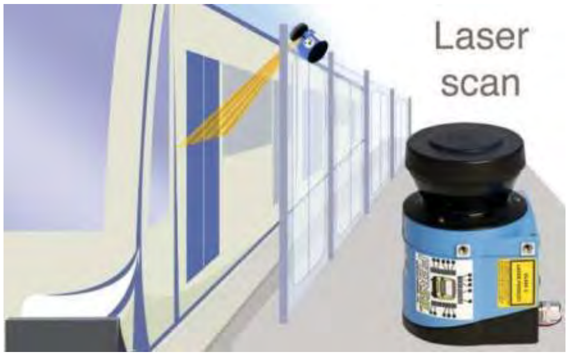
Dedicated Loop

The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically



If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.

For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

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1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4'-0"). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

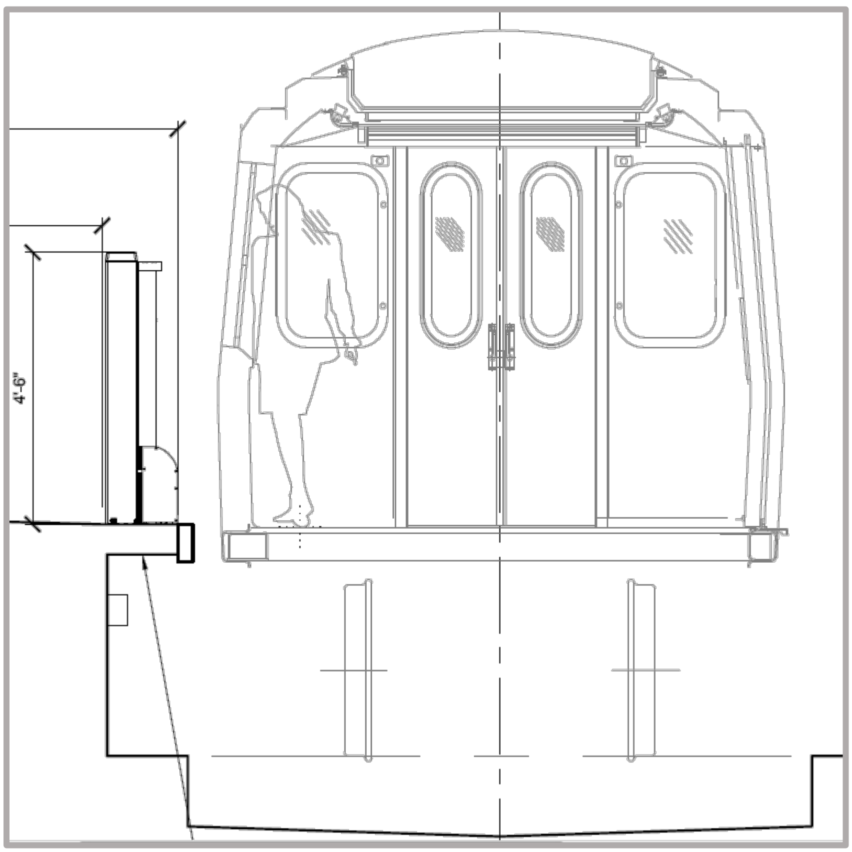

Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

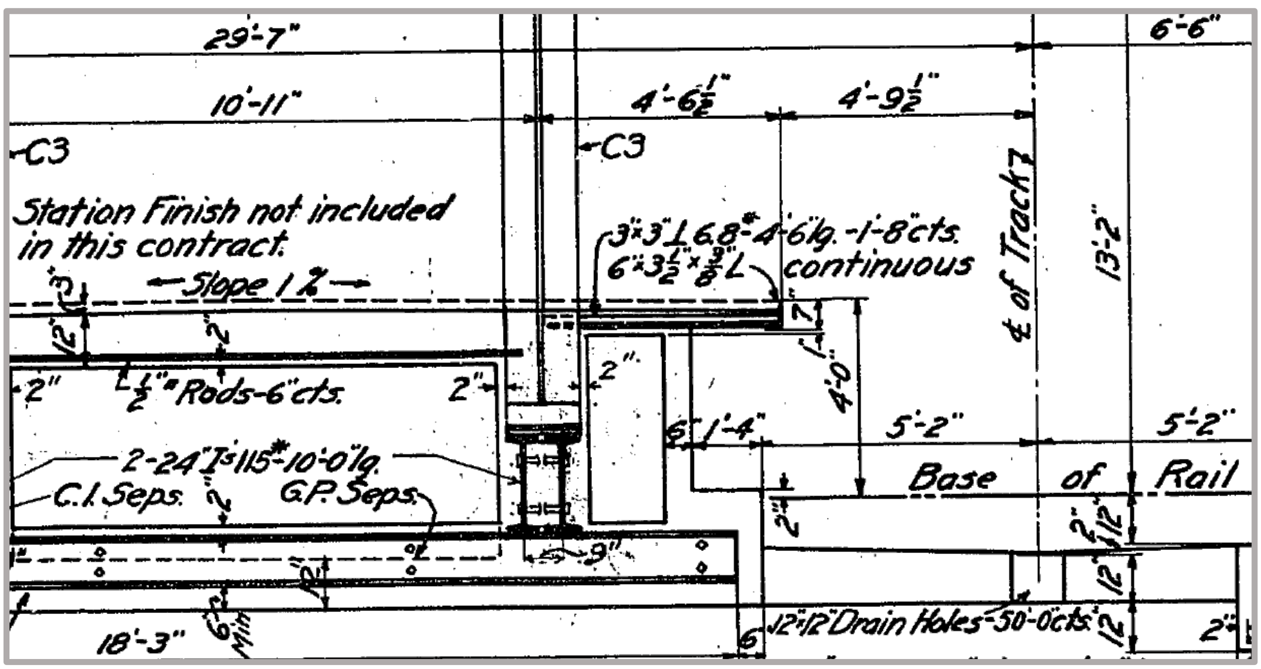

Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

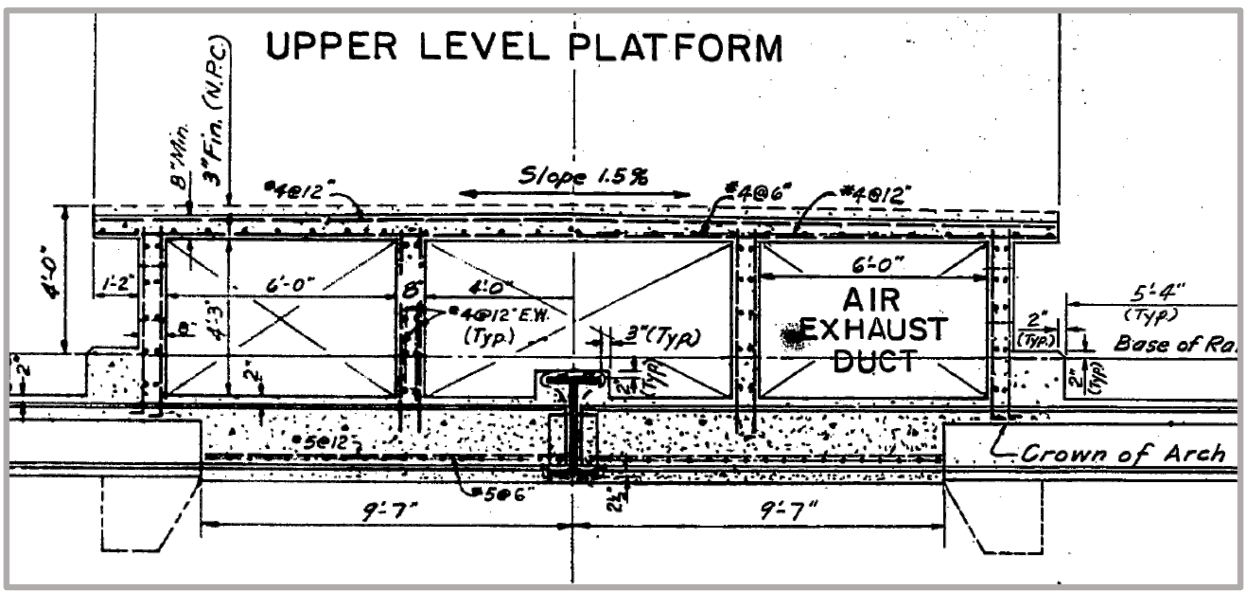

Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

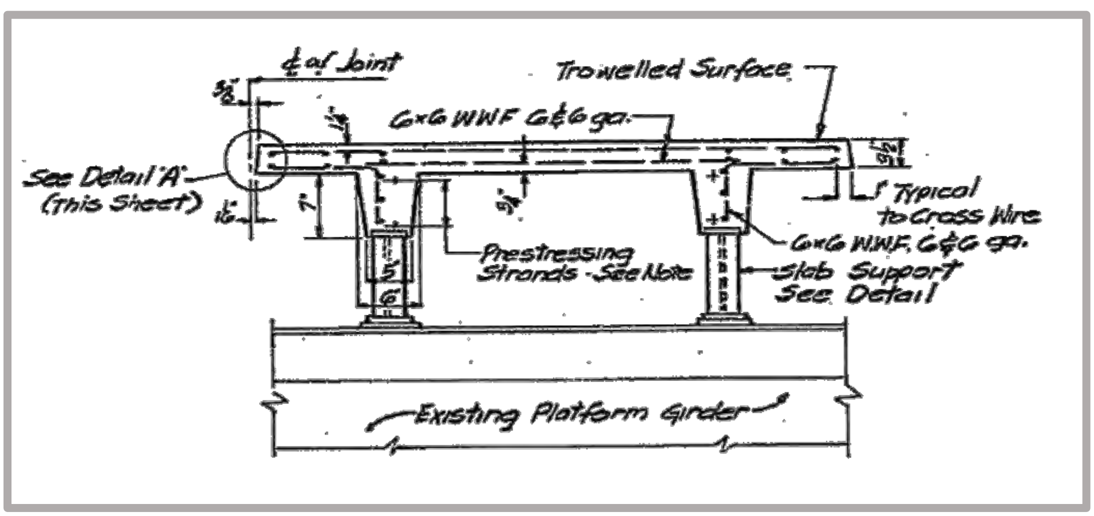

Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

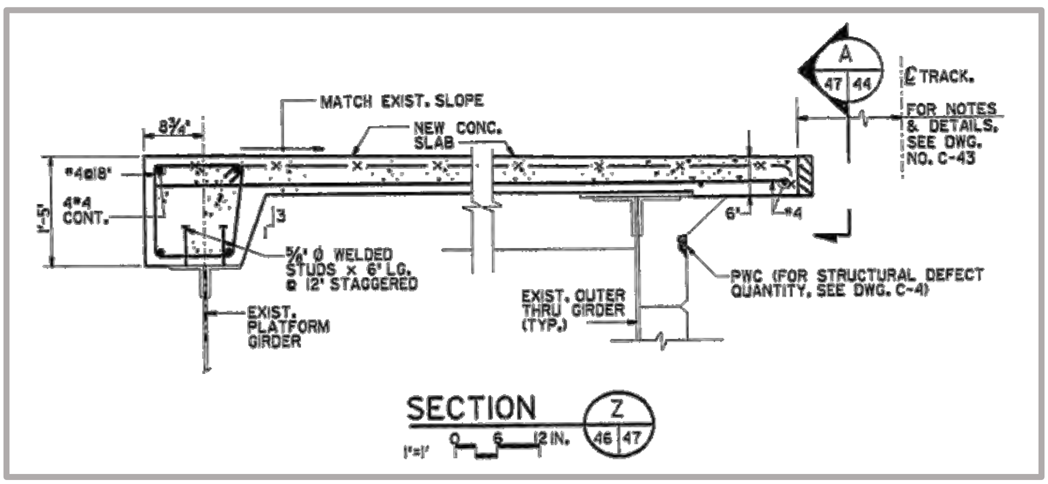

Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2'-9"), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

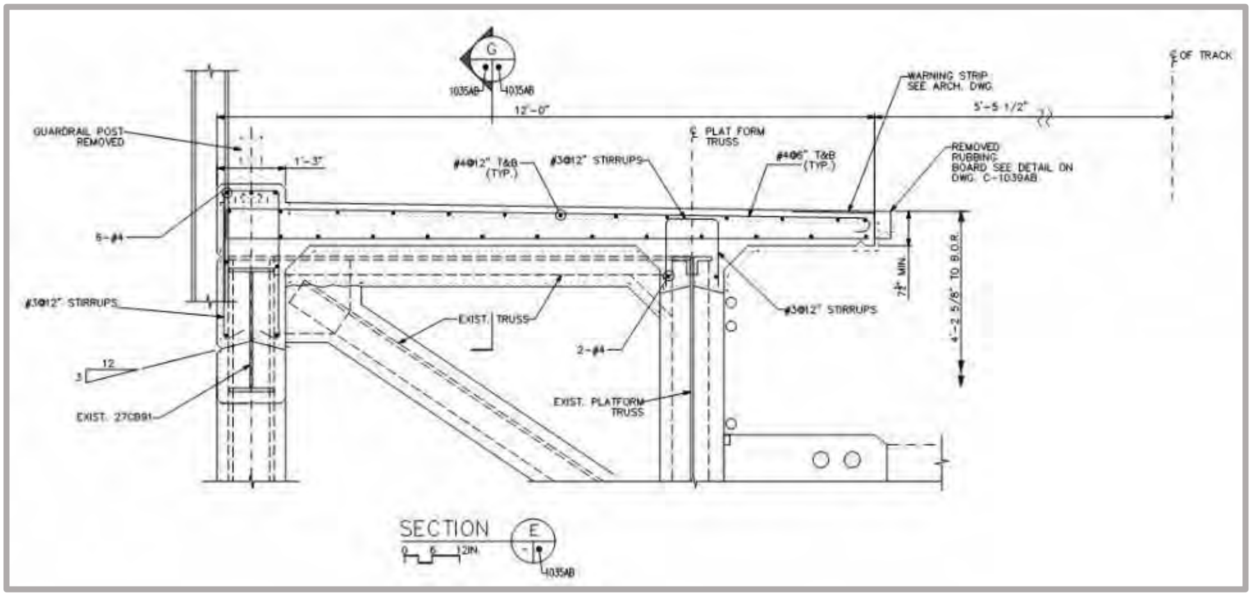

Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3" thick structural slab with an approximately 3" thick topping slab. If the topping slab is fully removed, a 6" thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6" thick slab will be sufficient for a cantilever length of up to approximately 3'-0", greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6" structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6" minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

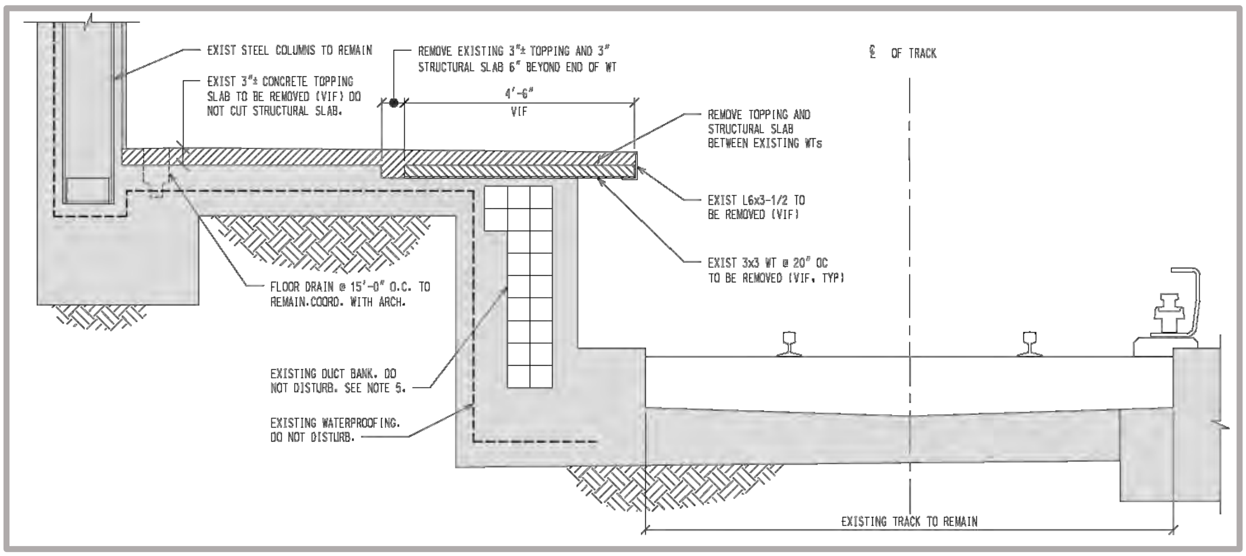

Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

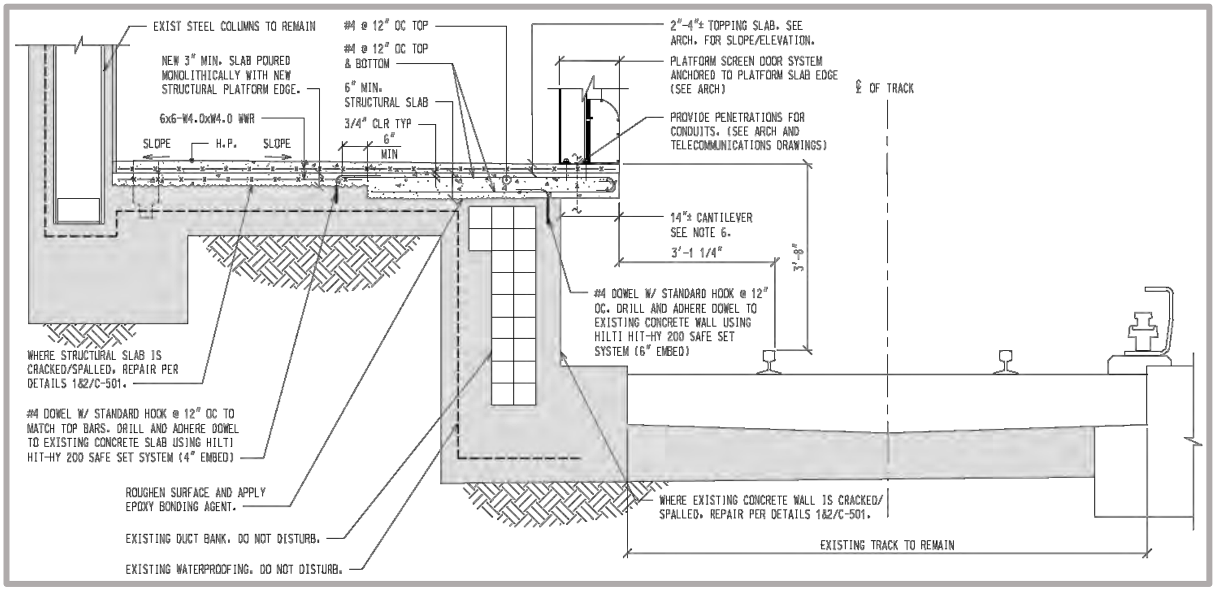

Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

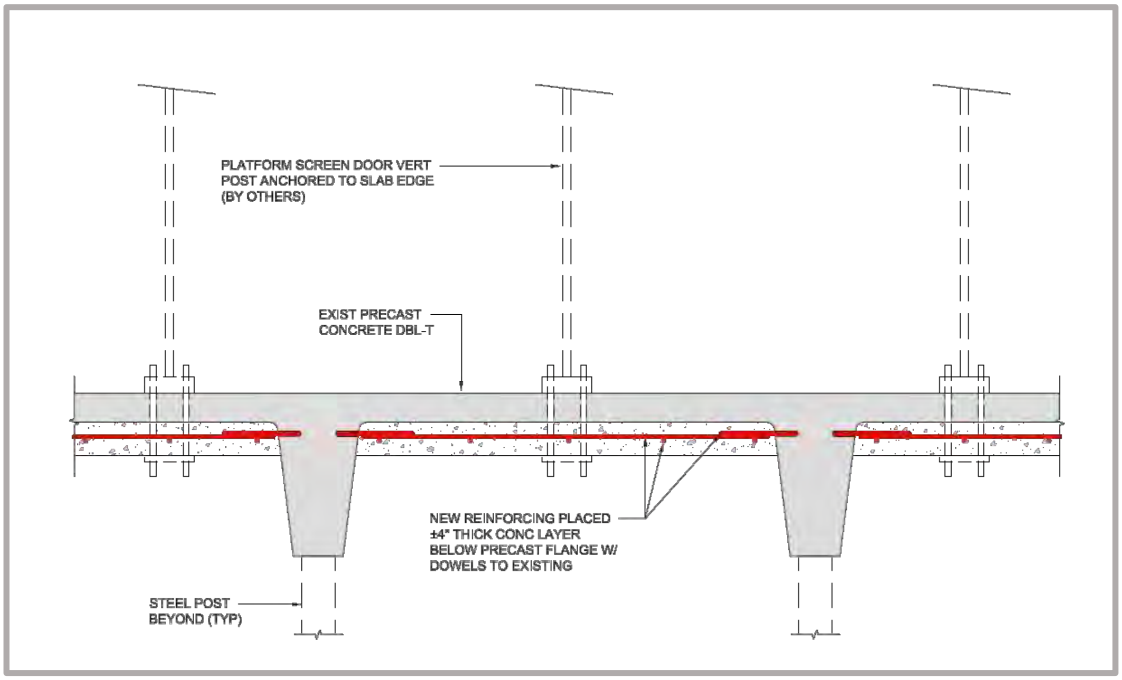

Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5' – 11" of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis

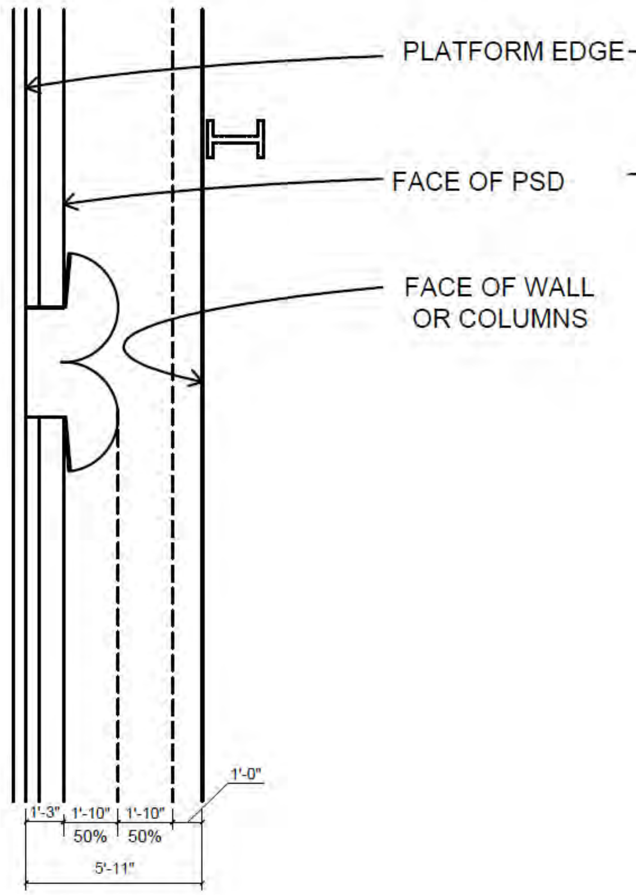

FIGURE 1: SIDE PLATFORM

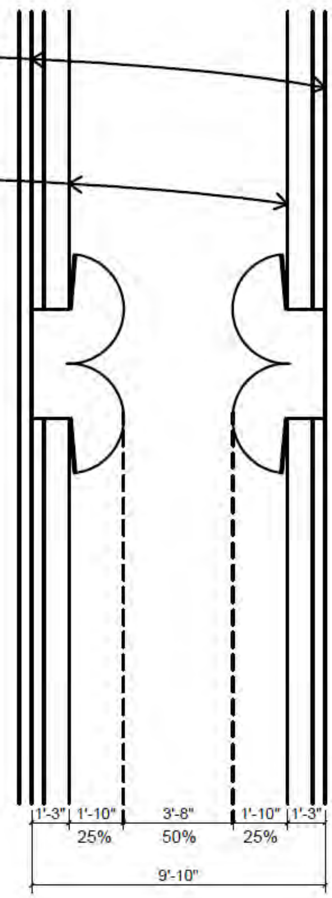

FIGURE 2: CENTER PLATFORM

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	9	$ 63,500 per month [Year 01]	$ 571,500		
		12	$ 83,590 per month [Year 02]	$ 1,003,080		
		12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment.	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
		12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663		

ITEM NO.	DESCRIPTION		RATE	
7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *	
		Year 3	$ 257 per hour *	
	Optional :	Year 4	$ 268 per hour *	
	Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations
ESTIMATE DATE:	June 24, 2019

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

MTA/NYCT

June 24, 2019

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.2 *APGs / PSDs will provide 39 emergency egress doors with push bars per platform*
1.3 *Each platform edge will have 50 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 It is assumed that each train has 10 cars on this line
2.2 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.3 In respect of the PSD option, only platforms that have not been upgraded in the recent past will require platform edge replacement.
2.4 There are no special security requirements made necessary by installation of the APG system
2.5 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.6 This estimate does not provide for the replacement of Platform Edge Lighting
2.7 Premium cost for night time work is considered 50% of total labor cost

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

MTA/NYCT

June 24, 2019

BASIS OF ESTIMATE

3.0 ***Exclusions - Costs not included in the estimate:***

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems
3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length
3.4 Costs associated with NYCT State Of Good Repair improvements to the station
3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.
3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs
3.7 Escalation Cost is not included; Anticipate at 5% per annum.
3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.
3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium
3.10 NYCT project cost is not included
3.11 GO and flagging cost is not included
3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or "soft" costs:***

4.1 Design and Construction Contingency
4.2 Contractor O & P
4.3 Insurance
4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 Given the limited time available, no drawings were developed to support this estimate.

MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

	ORDER OF MAGNITUDE COSTS		MRN 144	MRN 145	MRN 146	MRN 147	MRN 049	MRN 153		MRN 157	MRN 162	MR-164	MR-165
	DESCRIPTION		DYCKMAN ST	190TH ST	181ST STREET	175TH STREET	135TH STREET	125TH ST. NICHOLAS AVE.		96TH STREET	50TH STREET	34TH STREET PENN STATION	23RD STREET
								A - TRAIN	C - TRAIN			C - TRAIN	
1	AUTOMATIC PLATFORM GATES (APG'S)		$16,878,289	$16,923,166	$16,999,398	$16,902,656	$16,235,686	$16,665,081	$16,665,081	$16,338,296	$16,963,484	$16,994,141	$16,986,341
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$16,878,289	$16,923,166	$16,999,398	$16,902,656	$16,235,686	$16,665,081	$16,665,081	$16,338,296	$16,963,484	$16,994,141	$16,986,341
4	GENERAL REQUIREMENTS	15.00%	$2,531,743	$2,538,475	$2,549,910	$2,535,398	$2,435,353	$2,499,762	$2,499,762	$2,450,744	$2,544,523	$2,549,121	$2,547,951
	SUB-TOTAL:		$19,410,032	$19,461,641	$19,549,307	$19,438,054	$18,671,038	$19,164,843	$19,164,843	$18,789,040	$19,508,007	$19,543,262	$19,534,292
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,852,508	$4,865,410	$4,887,327	$4,859,513	$4,667,760	$4,791,211	$4,791,211	$4,697,260	$4,877,002	$4,885,815	$4,883,573
	SUB-TOTAL:		$24,262,540	$24,327,051	$24,436,634	$24,297,567	$23,338,798	$23,956,054	$23,956,054	$23,486,300	$24,385,009	$24,429,077	$24,417,865
6	OVERHEAD & PROFIT	15.00%	$3,639,381	$3,649,058	$3,665,495	$3,644,635	$3,500,820	$3,593,408	$3,593,408	$3,522,945	$3,657,751	$3,664,362	$3,662,680
	SUB-TOTAL:		$27,901,921	$27,976,108	$28,102,129	$27,942,202	$26,839,618	$27,549,462	$27,549,462	$27,009,245	$28,042,760	$28,093,439	$28,080,545
7	BONDS & INSURANCE	3.75%	$1,046,322	$1,049,104	$1,053,830	$1,047,833	$1,006,486	$1,033,105	$1,033,105	$1,012,847	$1,051,603	$1,053,504	$1,053,020
	SUB-TOTAL:		$28,948,243	$29,025,212	$29,155,959	$28,990,035	$27,846,104	$28,582,567	$28,582,567	$28,022,092	$29,094,363	$29,146,943	$29,133,565
	SUBTOTAL CONSTRUCTION COST W/O ACM		**$28,948,243**	**$29,025,212**	**$29,155,959**	**$28,990,035**	**$27,846,104**	**$28,582,567**	**$28,582,567**	**$28,022,092**	**$29,094,363**	**$29,146,943**	**$29,133,565**
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		**$28,948,243**	**$29,025,212**	**$29,155,959**	**$28,990,035**	**$27,846,104**	**$28,582,567**	**$28,582,567**	**$28,022,092**	**$29,094,363**	**$29,146,943**	**$29,133,565**
10	DESIGN CONSULTANT FEES	10.00%	$2,894,824	$2,902,521	$2,915,596	$2,899,004	$2,784,610	$2,858,257	$2,858,257	$2,802,209	$2,909,436	$2,914,694	$2,913,356
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		$31,843,067	$31,927,734	$32,071,555	$31,889,039	$30,630,714	$31,440,823	$31,440,823	$30,824,301	$32,003,800	$32,061,637	$32,046,921
	ADD ALTERNATIVES												
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		5,010,472	4,850,239	4,850,239	4,581,954	$4,631,954	4,882,078	4,882,078	$4,150,151	$5,454,954	$4,361,919	4,637,519
	Add for Markups (as above)	88.66%	4,442,430	4,300,362	4,300,362	4,062,493	4,106,824	4,328,592	4,328,592	3,679,644	4,836,520	3,867,404	4,111,759
	SUB-TOTAL PSD ALTERNATIVE		$9,452,902	$9,150,602	$9,150,602	$8,644,448	$8,738,778	$9,210,670	$9,210,670	$7,829,795	$10,291,473	$8,229,323	$8,749,278
	TOTAL PROJECT COST (PSD OPTION)		$41,295,969	$41,078,335	$41,222,157	$40,533,486	$39,369,492	$40,651,493	$40,651,493	$38,654,096	$42,295,273	$40,290,960	$40,796,199

	ORDER OF MAGNITUDE COSTS		MR-166		MR-167		MR-168	MR-169		MRN 172	MRN 176	MRN 177	MRN 178
	DESCRIPTION		14TH STREET		WEST 4TH STREET		SPRING STREET	CANAL STREET		FULTON ST	LAFAYETTE AVE	CLINTON & WASHINGTON AVENUES	FRANKLIN AVENUE
			A - TRAIN	C - TRAIN	A - TRAIN	C - TRAIN		A - TRAIN	C - TRAIN				
1	AUTOMATIC PLATFORM GATES (APG'S)		$17,095,398	$17,095,398	$17,195,305	$17,195,305	$17,033,141	$16,947,196	$16,947,196	$16,948,001	$16,985,819	$16,985,819	$17,029,731
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$17,095,398	$17,095,398	$17,195,305	$17,195,305	$17,033,141	$16,947,196	$16,947,196	$16,948,001	$16,985,819	$16,985,819	$17,029,731
4	GENERAL REQUIREMENTS	15.00%	$2,564,310	$2,564,310	$2,579,296	$2,579,296	$2,554,971	$2,542,079	$2,542,079	$2,542,200	$2,547,873	$2,547,873	$2,554,460
	SUB-TOTAL:		$19,659,707	$19,659,707	$19,774,600	$19,774,600	$19,588,112	$19,489,275	$19,489,275	$19,490,201	$19,533,692	$19,533,692	$19,584,190
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,914,927	$4,914,927	$4,943,650	$4,943,650	$4,897,028	$4,872,319	$4,872,319	$4,872,550	$4,883,423	$4,883,423	$4,896,048
	SUB-TOTAL:		$24,574,634	$24,574,634	$24,718,251	$24,718,251	$24,485,140	$24,361,594	$24,361,594	$24,362,752	$24,417,115	$24,417,115	$24,480,238
6	OVERHEAD & PROFIT	15.00%	$3,686,195	$3,686,195	$3,707,738	$3,707,738	$3,672,771	$3,654,239	$3,654,239	$3,654,413	$3,662,567	$3,662,567	$3,672,036
	SUB-TOTAL:		$28,260,829	$28,260,829	$28,425,988	$28,425,988	$28,157,911	$28,015,833	$28,015,833	$28,017,164	$28,079,682	$28,079,682	$28,152,273
7	BONDS & INSURANCE	3.75%	$1,059,781	$1,059,781	$1,065,975	$1,065,975	$1,055,922	$1,050,594	$1,050,594	$1,050,644	$1,052,988	$1,052,988	$1,055,710
	SUB-TOTAL:		$29,320,611	$29,320,611	$29,491,963	$29,491,963	$29,213,832	$29,066,427	$29,066,427	$29,067,808	$29,132,670	$29,132,670	$29,207,984
	SUBTOTAL CONSTRUCTION COST W/O ACM		**$29,320,611**	**$29,320,611**	**$29,491,963**	**$29,491,963**	**$29,213,832**	**$29,066,427**	**$29,066,427**	**$29,067,808**	**$29,132,670**	**$29,132,670**	**$29,207,984**
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		**$29,320,611**	**$29,320,611**	**$29,491,963**	**$29,491,963**	**$29,213,832**	**$29,066,427**	**$29,066,427**	**$29,067,808**	**$29,132,670**	**$29,132,670**	**$29,207,984**
10	DESIGN CONSULTANT FEES	10.00%	$2,932,061	$2,932,061	$2,949,196	$2,949,196	$2,921,383	$2,906,643	$2,906,643	$2,906,781	$2,913,267	$2,913,267	$2,920,798
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		**$32,252,672**	**$32,252,672**	**$32,441,159**	**$32,441,159**	**$32,135,216**	**$31,973,069**	**$31,973,069**	**$31,974,589**	**$32,045,937**	**$32,045,937**	**$32,128,782**
	ADD ALTERNATIVES												
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		5,067,206	4,854,549	4,550,700	4,550,700	$5,029,201	$5,614,286	$5,614,286	4,380,415	4,637,519	4,637,519	$4,619,281
	Add for Markups (as above)	88.66%	4,492,731	4,304,183	4,034,782	4,034,782	4,459,035	4,977,789	4,977,789	3,883,803	4,111,759	4,111,759	4,095,588
	SUB-TOTAL PSD ALTERNATIVE		**$9,559,937**	**$9,158,732**	**$8,585,482**	**$8,585,482**	**$9,488,235**	**$10,592,075**	**$10,592,075**	**$8,264,218**	**$8,749,278**	**$8,749,278**	**$8,714,869**
	TOTAL PROJECT COST (PSD OPTION)		**$41,812,609**	**$41,411,404**	**$41,026,641**	**$41,026,641**	**$41,623,451**	**$42,565,144**	**$42,565,144**	**$40,238,807**	**$40,795,215**	**$40,795,215**	**$40,843,651**

	ORDER OF MAGNITUDE COSTS		MRN 179	MRN 180	MRN 181		MRN 182	MRN 183	MRN 184		MRN 185	MRN 186	MRN 187
	DESCRIPTION		NOSTRAND AVENUE	KINGSTON THROOP AVENUES	UTICA AVENUE		RALPH AVENUE	ROCKAWAY AVENUE	BROADWAY JCT/EAST NY		LIBERTY AVE	VAN SICLEN AVE	SHEPHERD AVE
			A - TRAIN		A - TRAIN	C - TRAIN			A - TRAIN	C - TRAIN			
1	AUTOMATIC PLATFORM GATES (APG'S)		$17,034,412	$16,734,049	$16,467,990	$16,467,990	$16,702,849	$17,381,007	$16,441,339	$16,441,339	$16,362,534	$16,228,075	$16,363,534
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$17,034,412	$16,734,049	$16,467,990	$16,467,990	$16,702,849	$17,381,007	$16,441,339	$16,441,339	$16,362,534	$16,228,075	$16,363,534
4	GENERAL REQUIREMENTS	15.00%	$2,555,162	$2,510,107	$2,470,199	$2,470,199	$2,505,427	$2,607,151	$2,466,201	$2,466,201	$2,454,380	$2,434,211	$2,454,530
	SUB-TOTAL:		$19,589,574	$19,244,157	$18,938,189	$18,938,189	$19,208,277	$19,988,158	$18,907,540	$18,907,540	$18,816,914	$18,662,286	$18,818,064
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,897,394	$4,811,039	$4,734,547	$4,734,547	$4,802,069	$4,997,039	$4,726,885	$4,726,885	$4,704,229	$4,665,572	$4,704,516
	SUB-TOTAL:		$24,486,968	$24,055,196	$23,672,736	$23,672,736	$24,010,346	$24,985,197	$23,634,425	$23,634,425	$23,521,143	$23,327,858	$23,522,581
6	OVERHEAD & PROFIT	15.00%	$3,673,045	$3,608,279	$3,550,910	$3,550,910	$3,601,552	$3,747,780	$3,545,164	$3,545,164	$3,528,171	$3,499,179	$3,528,387
	SUB-TOTAL:		$28,160,013	$27,663,476	$27,223,646	$27,223,646	$27,611,898	$28,732,977	$27,179,589	$27,179,589	$27,049,314	$26,827,036	$27,050,968
7	BONDS & INSURANCE	3.75%	$1,056,000	$1,037,380	$1,020,887	$1,020,887	$1,035,446	$1,077,487	$1,019,235	$1,019,235	$1,014,349	$1,006,014	$1,014,411
	SUB-TOTAL:		$29,216,013	$28,700,856	$28,244,533	$28,244,533	$28,647,344	$29,810,463	$28,198,823	$28,198,823	$28,063,664	$27,833,050	$28,065,379
	SUBTOTAL CONSTRUCTION COST W/O ACM		$29,216,013	$28,700,856	$28,244,533	$28,244,533	$28,647,344	$29,810,463	$28,198,823	$28,198,823	$28,063,664	$27,833,050	$28,065,379
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		$29,216,013	$28,700,856	$28,244,533	$28,244,533	$28,647,344	$29,810,463	$28,198,823	$28,198,823	$28,063,664	$27,833,050	$28,065,379
10	DESIGN CONSULTANT FEES	10.00%	$2,921,601	$2,870,086	$2,824,453	$2,824,453	$2,864,734	$2,981,046	$2,819,882	$2,819,882	$2,806,366	$2,783,305	$2,806,538
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		$32,137,615	$31,570,941	$31,068,986	$31,068,986	$31,512,079	$32,791,510	$31,018,706	$31,018,706	$30,870,030	$30,616,355	$30,871,917
	ADD ALTERNATIVES												
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		5,909,515	4,483,496	4,483,637	4,483,637	$4,483,496	4,914,642	4,480,658	4,480,658	4,272,699	4,185,735	4,270,711
	Add for Markups (as above)	88.66%	5,239,547	3,975,197	3,975,322	3,975,322	3,975,197	4,357,463	3,972,681	3,972,681	3,788,299	3,711,194	3,786,536
	SUB-TOTAL PSD ALTERNATIVE		$11,149,061	$8,458,694	$8,458,959	$8,458,959	$8,458,694	$9,272,105	$8,453,338	$8,453,338	$8,060,998	$7,896,929	$8,057,247
	TOTAL PROJECT COST (PSD OPTION)		$43,286,676	$40,029,635	$39,527,945	$39,527,945	$39,970,772	$42,063,614	$39,472,044	$39,472,044	$38,931,028	$38,513,284	$38,929,164

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	ORDER OF MAGNITUDE COSTS		MRN 196	MRN 197	MRN 198	MRN 199	MRN 200	MRN 201	MRN 202	MRN 203	MRN 204	MRN 205	MRN 206
	DESCRIPTION		AQUEDUCT RACE TRACK	AQUEDUCT NORTH CONDUIT AVE	HOWARD BEACH AIRTRAIN	BROAD CHANNEL	BEACH 90TH ST	BEACH 98TH ST	BEACH 105TH ST	ROCKAWAY PARK BEACH 116TH ST	BEACH 67TH ST GASTON AVE	BEACH 60TH ST STATION AVE	BEACH 44TH ST FRANK AVE
1	AUTOMATIC PLATFORM GATES (APG'S)		$11,820,738	$18,864,318	$17,550,500	$17,286,801	$17,187,048	$19,030,157	$16,810,883	$17,932,183	$16,993,175	$17,338,835	$17,227,205
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$11,820,738	$18,864,318	$17,550,500	$17,286,801	$17,187,048	$19,030,157	$16,810,883	$17,932,183	$16,993,175	$17,338,835	$17,227,205
4	GENERAL REQUIREMENTS	15.00%	$1,773,111	$2,829,648	$2,632,575	$2,593,020	$2,578,057	$2,854,524	$2,521,632	$2,689,827	$2,548,976	$2,600,825	$2,584,081
	SUB-TOTAL:		$13,593,848	$21,693,965	$20,183,075	$19,879,821	$19,765,105	$21,884,681	$19,332,515	$20,622,010	$19,542,152	$19,939,660	$19,811,285
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$3,398,462	$5,423,491	$5,045,769	$4,969,955	$4,941,276	$5,471,170	$4,833,129	$5,155,502	$4,885,538	$4,984,915	$4,952,821
	SUB-TOTAL:		$16,992,310	$27,117,457	$25,228,844	$24,849,777	$24,706,381	$27,355,851	$24,165,644	$25,777,512	$24,427,690	$24,924,575	$24,764,107
6	OVERHEAD & PROFIT	15.00%	$2,548,847	$4,067,618	$3,784,327	$3,727,466	$3,705,957	$4,103,378	$3,624,847	$3,866,627	$3,664,153	$3,738,686	$3,714,616
	SUB-TOTAL:		$19,541,157	$31,185,075	$29,013,171	$28,577,243	$28,412,338	$31,459,228	$27,790,491	$29,644,139	$28,091,843	$28,663,261	$28,478,723
7	BONDS & INSURANCE	3.75%	$732,793	$1,169,440	$1,087,994	$1,071,647	$1,065,463	$1,179,721	$1,042,143	$1,111,655	$1,053,444	$1,074,872	$1,067,952
	SUB-TOTAL:		$20,273,950	$32,354,515	$30,101,165	$29,648,890	$29,477,801	$32,638,949	$28,832,634	$30,755,794	$29,145,287	$29,738,133	$29,546,675
	SUBTOTAL CONSTRUCTION COST W/O ACM		**$20,273,950**	**$32,354,515**	**$30,101,165**	**$29,648,890**	**$29,477,801**	**$32,638,949**	**$28,832,634**	**$30,755,794**	**$29,145,287**	**$29,738,133**	**$29,546,675**
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		**$20,273,950**	**$32,354,515**	**$30,101,165**	**$29,648,890**	**$29,477,801**	**$32,638,949**	**$28,832,634**	**$30,755,794**	**$29,145,287**	**$29,738,133**	**$29,546,675**
10	DESIGN CONSULTANT FEES	10.00%	$2,027,395	$3,235,452	$3,010,116	$2,964,889	$2,947,780	$3,263,895	$2,883,263	$3,075,579	$2,914,529	$2,973,813	$2,954,667
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		**$22,301,345**	**$35,589,967**	**$33,111,281**	**$32,613,779**	**$32,425,581**	**$35,902,844**	**$31,715,897**	**$33,831,374**	**$32,059,816**	**$32,711,947**	**$32,501,342**
	ADD ALTERNATIVES												
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		-	-	-	-	-	$0	-	-	-	$0	-
	Add for Markups (as above)	88.66%	0	0	0	0	0	0	0	0	0	0	0
	SUB-TOTAL PSD ALTERNATIVE		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	TOTAL PROJECT COST (PSD OPTION)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

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June 24, 2019

	ORDER OF MAGNITUDE COSTS		MRN 207	MRN 208	MRN 209
	DESCRIPTION		BEACH 36TH ST	BEACH 25TH ST.	FAR ROCKAWAY MOTT AVE.
1	AUTOMATIC PLATFORM GATES (APG'S)		$17,236,784	$17,763,604	$17,186,323
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$17,236,784	$17,763,604	$17,186,323
4	GENERAL REQUIREMENTS	15.00%	$2,585,518	$2,664,541	$2,577,948
	SUB-TOTAL:		$19,822,301	$20,428,145	$19,764,271
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,955,575	$5,107,036	$4,941,068
	SUB-TOTAL:		$24,777,876	$25,535,181	$24,705,339
6	OVERHEAD & PROFIT	15.00%	$3,716,681	$3,830,277	$3,705,801
	SUB-TOTAL:		$28,494,558	$29,365,458	$28,411,140
7	BONDS & INSURANCE	3.75%	$1,068,546	$1,101,205	$1,065,418
	SUB-TOTAL:		$29,563,104	$30,466,663	$29,476,558
	SUBTOTAL CONSTRUCTION COST W/O ACM		$29,563,104	$30,466,663	$29,476,558
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		$29,563,104	$30,466,663	$29,476,558
10	DESIGN CONSULTANT FEES	10.00%	$2,956,310	$3,046,666	$2,947,656
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		$32,519,414	$33,513,329	$32,424,214
	ADD ALTERNATIVES				
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		-	-	-
	Add for Markups (as above)	88.66%	0	0	0
	SUB-TOTAL PSD ALTERNATIVE		$0	$0	$0
	TOTAL PROJECT COST (PSD OPTION)		$0	$0	$0

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : DYCKMAN ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	653	LF		
5	LENGTH OF THE PLATFORM EDGE =	653	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,306**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,306	LF	7	9,142
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,530	SF	12	78,360
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	132	CY	2,500	330,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,308	EA	25	32,700
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,308	EA	25	32,700
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,306	LF	95	124,070
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,306	LF	15	19,590
26	Remove existing platform tiles	1,306	LF	12	15,672
27	Sawcut existing topping concrete at perimeter of removal area	1,306	LF	5	6,530
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,836	SF	8	62,688
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-0" wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,306	SF	15	19,590

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : DYCKMAN ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,592	SF	750	1,944,000
61	Spare Parts - Approx. 10% of Material Cost	1	LS	243,300	243,300
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : DYCKMAN ST

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,306	LF	60	78,360
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	356	LF	60	21,360
75	Reserve power to PSD Room from EDR [Conduit & Cable]	406	LF	60	24,360
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : DYCKMAN ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,894,990	3,894,990
112					
113	TOTAL PSD WORK:				$ 16,878,289
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,582	SF	750	4,186,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	449,302	449,302
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	86,622
129	L6x6x1/2 continuous angle	10	TONS	17,500	168,213
130	Drilling and bolting - 4 bolts at each connection	522	EA	216	112,838
131	Platform Edge Repair				
132	Remove concrete platform edge	1,306	LF	27	35,262
133	Platform edge repair	1,306	LF	109	142,354
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
135	Signal Work [Each 300’ length is associated with one signal light]				
136	Disconnects	80	HRS	162	12,960
137	Remove signal cables	600	LF	40	24,000
138	Remove conduit; Assuming 1”	600	LF	55	33,000
139	Install conduit in new position	600	LF	110	66,000
140	Install replacement cable; assumed single cable #12	600	LF	125	75,000
141	Re-commission / testing as required	2	EA	12,500	25,000
142	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
143	Premium Time	1,569	HRS	49	76,253
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : DYCKMAN ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,592)	SF	750	(1,944,000)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	243,300	(243,300)
152	Platform Edge Reconstruction work	(1)	LS	588,960	(588,960)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,306)	LF	30	(39,180)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,156,263	1,156,263
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 5,010,472

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 190TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	660	LF		
5	LENGTH OF THE PLATFORM EDGE =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,320**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 15'-8" wide	774	SF	8	6,189
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 190TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	774	SF	15	11,604
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,655	SF	750	1,991,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	246,135	246,135
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 190TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 190TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,905,346	3,905,346
112					
113	TOTAL PSD WORK:				$ 16,923,166
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,694	SF	750	4,270,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	454,342	454,342
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
129	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
130	Drilling and bolting - 4 bolts at each connection	528	EA	216	114,048
131	Platform Edge Repair				
132	Remove concrete platform edge	1,320	LF	27	35,640
133	Platform edge repair	1,320	LF	109	143,880
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	40	HRS	162	6,480
137	Remove signal cables	300	LF	40	12,000
138	Remove conduit; Assuming 1"	300	LF	55	16,500
139	Install conduit in new position	300	LF	110	33,000
140	Install replacement cable; assumed single cable #12	300	LF	125	37,500
141	Re-commission / testing as required	1	EA	12,500	12,500
142	Engineering / Shop Drawings / Etc.	1	EA	7,500	7,500
143	Premium Time	785	HRS	49	38,151
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 190TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,655)	SF	750	(1,991,250)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,135	(246,135)
152	Platform Edge Reconstruction work	(1)	LS	593,000	(593,000)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,119,286	1,119,286
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,850,239

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 181ST STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	660	LF		
5	LENGTH OF THE PLATFORM EDGE =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,320**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 11'-8" wide	454	SF	8	3,629
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 181ST STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	454	SF	15	6,804
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,655	SF	750	1,991,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	246,135	246,135
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 181ST STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	650	LF	60	39,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	700	LF	60	42,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 181ST STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,922,938	3,922,938
112					
113	TOTAL PSD WORK:				$ 16,999,398
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,694	SF	750	4,270,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	454,342	454,342
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
129	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
130	Drilling and bolting - 4 bolts at each connection	528	EA	216	114,048
131	Platform Edge Repair				
132	Remove concrete platform edge	1,320	LF	27	35,640
133	Platform edge repair	1,320	LF	109	143,880
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	40	HRS	162	6,480
137	Remove signal cables	300	LF	40	12,000
138	Remove conduit; Assuming 1"	300	LF	55	16,500
139	Install conduit in new position	300	LF	110	33,000
140	Install replacement cable; assumed single cable #12	300	LF	125	37,500
141	Re-commission / testing as required	1	EA	12,500	12,500
142	Engineering / Shop Drawings / Etc.	1	EA	7,500	7,500
143	Premium Time	785	HRS	49	38,151

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 181ST STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,655)	SF	750	(1,991,250)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,135	(246,135)
152	Platform Edge Reconstruction work	(1)	LS	593,000	(593,000)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,119,286	1,119,286
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,850,239

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 175TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE =	657	LF		
5	LENGTH OF THE PLATFORM EDGE =	657	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,314**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,314	LF	7	9,195
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,568	SF	12	78,810
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	132	CY	2,500	330,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,316	EA	25	32,888
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,316	EA	25	32,888
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,314	LF	95	124,783
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,314	LF	15	19,703
26	Remove existing platform tiles	1,314	LF	12	15,762
27	Sawcut existing topping concrete at perimeter of removal area	1,314	LF	5	6,568
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,881	SF	8	63,048
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 19'-0" wide	1,040	SF	8	8,320
30	New Work				
31	New concrete topping to match existing	1,314	SF	15	19,703
32	New concrete topping at ADA boarding area to match existing	1,040	SF	15	15,600

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 175TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,626	SF	750	1,969,313
61	Spare Parts - Approx. 10% of Material Cost	1	LS	244,819	244,819
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
71	Allow for conduit / cable runs for power and communications under platform edge	1,314	LF	60	78,810

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 175TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
74	Power to PSD Room from EDR including track crossing if needed	200	LF	60	12,000
75	Reserve power to PSD Room from EDR including track crossing if needed	250	LF	60	15,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
79	MISC				
80	Testing and commissioning	1	LS	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 175TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,900,613	3,900,613
113	TOTAL PSD WORK:				$ 16,902,656

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,642	SF	750	4,231,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	452,002	452,002
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	87,112
129	L6x6x1/2 continuous angle	10	TONS	17,500	169,179
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Platform Edge Repair				
132	Remove concrete platform edge	1,314	LF	27	35,465
133	Platform edge repair	1,314	LF	109	143,172
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 175TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,626)	SF	750	(1,969,313)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	244,819	(244,819)
152	Platform Edge Reconstruction work	(1)	LS	589,785	(589,785)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,314)	LF	30	(39,405)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,057,374	1,057,374
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				**4,581,954**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 135TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	598	LF		
5	LENGTH OF THE PLATFORM EDGE =	598	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,196**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,196	LF	7	8,372
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,980	SF	12	71,760
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	120	CY	2,500	300,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,198	EA	25	29,950
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,198	EA	25	29,950
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,196	LF	95	113,620
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,196	LF	15	17,940
26	Remove existing platform tiles	1,196	LF	12	14,352
27	Sawcut existing topping concrete at perimeter of removal area	1,196	LF	5	5,980
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,176	SF	8	57,408
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 5'-9" wide	460	SF	8	3,680
30	New Work				
31	New concrete topping to match existing	1,196	SF	15	17,940

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 135TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	460	SF	15	6,900
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,097	SF	750	1,572,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	221,025	221,025
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 135TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,196	LF	60	71,760
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 135TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,746,697	3,746,697
112					
113	TOTAL PSD WORK:				$ 16,235,686
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,702	SF	750	3,526,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	409,702	409,702
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	79,436
129	L6x6x1/2 continuous angle	9	TONS	17,500	154,045
130	Drilling and bolting - 4 bolts at each connection	478	EA	216	103,334
131	Platform Edge Repair				
132	Remove concrete platform edge	1,196	LF	27	32,292
133	Platform edge repair	1,196	LF	109	130,364
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	624	EA	10	6,240
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	80	HRS	162	12,960
137	Remove signal cables	600	LF	40	24,000
138	Remove conduit; Assuming 1"	600	LF	55	33,000
139	Install conduit in new position	600	LF	110	66,000
140	Install replacement cable; assumed single cable #12	600	LF	125	75,000
141	Allow for remove and reinstall conductor boxes	4	EA	3,000	12,000
142	Re-commission / testing as required	2	EA	12,500	25,000
143	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
144	Premium Time	1,644	HRS	49	79,898

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 135TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,097)	SF	750	(1,572,750)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	221,025	(221,025)
153	Platform Edge Reconstruction work	(1)	LS	546,860	(546,860)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,196)	LF	30	(35,880)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,068,912	1,068,912
158					
159	PREMIUM ASSOCIATED WITH PSD's				$ 4,631,954

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 125TH ST. NICHOLAS AVE. - A TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE (A - TRAIN) =	634	LF		
5	LENGTH OF THE PLATFORM EDGE (A - TRAIN) =	634	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,268**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,268	LF	7	8,876
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,340	SF	12	76,080
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	128	CY	2,500	320,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,270	EA	25	31,750
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,270	EA	25	31,750
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,268	LF	95	120,460
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,268	LF	15	19,020
26	Remove existing platform tiles	1,268	LF	12	15,216
27	Sawcut existing topping concrete at perimeter of removal area	1,268	LF	5	6,340
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,608	SF	8	60,864
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 7'-0" wide	560	SF	8	4,480
30	New Work				
31	New concrete topping to match existing	1,268	SF	15	19,020

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 125TH ST. NICHOLAS AVE. - A TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	560	SF	15	8,400
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room - A Train [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,421	SF	750	1,815,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	235,605	235,605
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 125TH ST. NICHOLAS AVE. - A TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,268	LF	60	76,080
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	300	LF	60	18,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	350	LF	60	21,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 125TH ST. NICHOLAS AVE. - A TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,845,788	3,845,788
112					
113	TOTAL PSD WORK:				$ 16,665,081
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,278	SF	750	3,958,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	435,622	435,622
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	84,140
129	L6x6x1/2 continuous angle	9	TONS	17,500	163,318
130	Drilling and bolting - 4 bolts at each connection	507	EA	216	109,555
131	Platform Edge Repair				
132	Remove concrete platform edge	1,268	LF	27	34,236
133	Platform edge repair	1,268	LF	109	138,212
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	624	EA	10	6,240
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	80	HRS	162	12,960
137	Remove signal cables	600	LF	40	24,000
138	Remove conduit; Assuming 1"	600	LF	55	33,000
139	Install conduit in new position	600	LF	110	66,000
140	Install replacement cable; assumed single cable #12	600	LF	125	75,000
141	Allow for remove and reinstall conductor boxes	2	EA	3,000	6,000
142	Re-commission / testing as required	2	EA	12,500	25,000
143	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
144	Premium Time	1,606	HRS	49	78,052

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 125TH ST. NICHOLAS AVE. - A TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,421)	SF	750	(1,815,750)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	235,605	(235,605)
153	Platform Edge Reconstruction work	(1)	LS	574,780	(574,780)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,268)	LF	30	(38,040)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,126,633	1,126,633
158					
159	PREMIUM ASSOCIATED WITH PSD's				$ 4,882,078

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 125TH ST. NICHOLAS AVE. - C TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE (C - TRAIN) =	634	LF		
5	LENGTH OF THE PLATFORM EDGE (C - TRAIN) =	634	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,268**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,268	LF	7	8,876
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,340	SF	12	76,080
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	128	CY	2,500	320,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,270	EA	25	31,750
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,270	EA	25	31,750
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,268	LF	95	120,460
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,268	LF	15	19,020
26	Remove existing platform tiles	1,268	LF	12	15,216
27	Sawcut existing topping concrete at perimeter of removal area	1,268	LF	5	6,340
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,608	SF	8	60,864
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 7'-0" wide	560	SF	8	4,480
30	New Work				
31	New concrete topping to match existing	1,268	SF	15	19,020

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 125TH ST. NICHOLAS AVE. - C TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	560	SF	15	8,400
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room - C Train [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,421	SF	750	1,815,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	235,605	235,605
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 125TH ST. NICHOLAS AVE. - C TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,268	LF	60	76,080
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	300	LF	60	18,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	350	LF	60	21,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 125TH ST. NICHOLAS AVE. - C TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,845,788	3,845,788
112					
113	TOTAL PSD WORK:				$ 16,665,081
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,278	SF	750	3,958,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	435,622	435,622
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	84,140
129	L6x6x1/2 continuous angle	9	TONS	17,500	163,318
130	Drilling and bolting - 4 bolts at each connection	507	EA	216	109,555
131	Platform Edge Repair				
132	Remove concrete platform edge	1,268	LF	27	34,236
133	Platform edge repair	1,268	LF	109	138,212
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	624	EA	10	6,240
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	80	HRS	162	12,960
137	Remove signal cables	600	LF	40	24,000
138	Remove conduit; Assuming 1"	600	LF	55	33,000
139	Install conduit in new position	600	LF	110	66,000
140	Install replacement cable; assumed single cable #12	600	LF	125	75,000
141	Allow for remove and reinstall conductor boxes	2	EA	3,000	6,000
142	Re-commission / testing as required	2	EA	12,500	25,000
143	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
144	Premium Time	1,606	HRS	49	78,052

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 125TH ST. NICHOLAS AVE. - C TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,421)	SF	750	(1,815,750)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	235,605	(235,605)
153	Platform Edge Reconstruction work	(1)	LS	574,780	(574,780)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,268)	LF	30	(38,040)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,126,633	1,126,633
158					
159	PREMIUM ASSOCIATED WITH PSD's				$ 4,882,078

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 96TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE UPPER PLATFORM EDGE=	614	LF		
5	LENGTH OF THE LOWER PLATFORM EDGE =	614	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,228**	**LF**		
7	NUMBER OF TRAIN CARS ON W TRAIN TRACK =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,228	LF	7	8,596
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,140	SF	12	73,680
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,230	EA	25	30,750
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,230	EA	25	30,750
19	Cast in assemblies for PSD holding down bolts	320	EA	180	57,600
20	Polyethylene edge strip	1,228	LF	95	116,660
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,228	LF	15	18,420
26	Remove existing platform tiles	1,228	LF	12	14,736
27	Sawcut existing topping concrete at perimeter of removal area	1,228	LF	5	6,140
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,368	SF	8	58,944
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 5'-11" wide	473	SF	8	3,787
30	New Work				
31	New concrete topping to match existing	1,228	SF	15	18,420

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 96TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	473	SF	15	7,100
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,241	SF	750	1,680,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	227,505	227,505
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 96TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,228	LF	60	73,680
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 96TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,770,376	3,770,376
112					
113	TOTAL PSD WORK:				$ 16,338,296
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,958	SF	750	3,718,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	421,222	421,222
127	Structural framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,527
129	L6x6x1/2 continuous angle	9	TONS	17,500	158,166
130	Drilling and bolting - 4 bolts at each connection	491	EA	216	106,099
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 96TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,241)	SF	750	(1,680,750)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	227,505	(227,505)
152	Platform Edge Reconstruction work	(1)	LS	502,780	(502,780)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,228)	LF	30	(36,840)
155					
156	Allow loss of production to work at night say 50%	1	LS	957,727	957,727
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				**$ 4,150,151**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 50TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	660	LF		
5	LENGTH OF THE PLATFORM EDGE =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,320**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 15'-8" wide strip	851	SF	8	6,808
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 50TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	851	SF	15	12,764
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,655	SF	750	1,991,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	246,135	246,135
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 50TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	Allowance for power to cross tracks to opposite platform [Upper level]	1	LS	15,000	15,000
77	Allowance for power to cross tracks to opposite platform [Lower level]	1	LS	15,000	15,000
78	No allowance for new lighting as if APG's are used		Note		EXCL.
79	Grounding				
80	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
81	MISC				
82	Testing and commissioning	1	EA	30,000	30,000
83	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
84					
85	**Communications**				
86	FA System				
87	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
88	CCTV coverage				
89	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
90	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
91	Berthing Technology Sensors				
92	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
93	Train Door Detection System				
94	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
95	Entrapment concerns				
96	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
97	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
98	Engineering and Testing	1,000	Hrs	160	159,930
99	Centralized monitoring/control				
100	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 50TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
101	MISC				
102	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
103	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
104	Site Survey and Inspections	1	LS	100,000	100,000
105	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
106	Furnish Test Equipment allowance	1	LS	500,000	500,000
107	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
108					
109	Training				
110	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
111					
112	Out of hours Work				
113	Allow loss of production to work at night say 50%	1	LS	3,914,650	3,914,650
115	TOTAL PSD WORK:				$ 16,963,484

117					
118	ADD ALTERNATIVE				
119					
120	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
121					
122	ADD				
123	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
124	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
125	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
126	Platform End Gates (PEGs)	4	EA	18,000	72,000
127	Fixed Panels including framing and support; Assuming 8'-0" high	5,694	SF	750	4,270,365
128	Spare Parts - Approx. 10% of Material Cost	1	LS	454,342	454,342
129	Structual framing / bracing				
130	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
131	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
132	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
133	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long	1	LS	350,000	350,000
134	Platform Edge Repair				
135	Remove concrete platform edge				Previously done
136	Platform edge repair				Previously done
137	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
138	Signal Work [Each 300' length is associated with one signal light]				
139	Disconnects	120	HRS	162	19,440
140	Remove signal cables	900	LF	40	36,000
141	Remove conduit; Assuming 1”	900	LF	55	49,500

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : 50TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Install conduit in new position	900	LF	110	99,000
143	Install replacement cable; assumed single cable #12	900	LF	125	112,500
144	Re-commission / testing as required	3	EA	12,500	37,500
145	Engineering / Shop Drawings / Etc.	3	EA	7,500	22,500
146	Premium Time	2,353	HRS	49	114,356
147					
148	OMIT				
149	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
150	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
151	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
152	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
153	Fixed Panels including framing and support; 4'-6" High	(2,655)	SF	750	(1,991,250)
154	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,135	(246,135)
155	Platform Edge Reconstruction work	(1)	LS	593,000	(593,000)
156	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
157	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
158					
159	Allow loss of production to work at night say 50%	1	LS	1,258,835	1,258,835
160					
161					
162	**PREMIUM ASSOCIATED WITH PSD's**				**5,454,954**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 34TH STREET PENN STATION

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	660	LF		
5	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,320**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 34TH STREET PENN STATION

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room - Upper Platform [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,655	SF	750	1,991,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	246,135	246,135
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 34TH STREET PENN STATION

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	200	LF	60	12,000
76	Allowance for power to cross tracks to opposite platform; 4 Tracks between Platforms	1	LS	35,000	35,000
77	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	1,000	Hrs	160	159,930
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 34TH STREET PENN STATION

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	3,921,725	3,921,725
114	TOTAL PSD WORK:				$ 16,994,141

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	5,694	SF	750	4,270,365
127	Spare Parts - Approx. 10% of Material Cost	1	LS	454,342	454,342
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
130	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Platform Edge Repair				
133	Remove concrete platform edge				Previously done
134	Platform edge repair				Previously done
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
136	Signal Work [Each 300' length is associated with one signal light]				
137	Disconnects				Not Applicable
138	Remove signal cables				Not Applicable
139	Remove conduit; Assuming 1"				Not Applicable
140	Install conduit in new position				Not Applicable
141	Install replacement cable; assumed single cable #12				Not Applicable
142	Re-commission / testing as required				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 34TH STREET PENN STATION

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
143	Engineering / Shop Drawings / Etc.				Not Applicable
144	Premium Time				Not Applicable
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,655)	SF	750	(1,991,250)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,135	(246,135)
153	Platform Edge Reconstruction work	(1)	LS	593,000	(593,000)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,006,597	1,006,597
158					
159	**PREMIUM ASSOCIATED WITH PSD's**				**4,361,919**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 23RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	660	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,320**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 23RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,655	SF	750	1,991,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	246,135	246,135
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 23RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	Allowance for power to cross tracks to opposite platform; 4 Tracks between Platforms	1	LS	35,000	35,000
77	No allowance for new lighting as if APG's are used		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	1,000	Hrs	160	159,930
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000

Table of Contents Appendix Table of Contents

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 23RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	3,919,925	3,919,925
113					
114	TOTAL PSD WORK:				$ 16,986,341

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	5,694	SF	750	4,270,365
127	Spare Parts - Approx. 10% of Material Cost	1	LS	454,342	454,342
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
130	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
131	Drilling and bolting - 4 bolts at each connection	528	EA	216	114,048
132	Platform Edge Repair				
133	Remove concrete platform edge	1,320	LF	27	35,640
134	Platform edge repair	1,320	LF	109	143,880
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
136					
137	OMIT				
138	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
139	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
140	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
141	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 23RD STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
142	Fixed Panels including framing and support; 4'-6" High	(2,655)	SF	750	(1,991,250)
143	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,135	(246,135)
144	Platform Edge Reconstruction work	(1)	LS	593,000	(593,000)
145	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
146	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
148	Allow loss of production to work at night say 50%	1	LS	1,070,197	1,070,197
149					
150					
151	**PREMIUM ASSOCIATED WITH PSD's**				**4,637,519**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 14TH STREET - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE (A - TRAIN) =	670	LF		
5	LENGTH OF THE PLATFORM EDGE (A - TRAIN) =	670	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,340**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,340	LF	7	9,380
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,700	SF	12	80,400
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	135	CY	2,500	337,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,342	EA	25	33,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,342	EA	25	33,550
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,340	LF	95	127,300
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,340	LF	15	20,100
26	Remove existing platform tiles	1,340	LF	12	16,080
27	Sawcut existing topping concrete at perimeter of removal area	1,340	LF	5	6,700
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,040	SF	8	64,320
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,340	SF	15	20,100

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 14TH STREET - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room - A Train [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,745	SF	750	2,058,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	250,185	250,185
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 14TH STREET - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,340	LF	60	80,400
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	Allowance for power to cross tracks to opposite platform; 4 Tracks between Platforms	1	LS	35,000	35,000
77	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	1,000	Hrs	160	159,930
98	Centralized monitoring/control	.			
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 14TH STREET - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	3,945,092	3,945,092
114	TOTAL PSD WORK:				$ 17,095,398

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	5,854	SF	750	4,390,365
127	Spare Parts - Approx. 10% of Material Cost	1	LS	461,542	461,542
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	88,843
130	L6x6x1/2 continuous angle	10	TONS	17,500	172,592
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Platform Edge Repair				
133	Remove concrete platform edge				Previously done
134	Platform edge repair				Previously done
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
136	Signal Work [Each 300' length is associated with one signal light]				
137	Disconnects	120	HRS	162	19,440
138	Remove signal cables	900	LF	40	36,000
139	Remove conduit; Assuming 1”	900	LF	55	49,500
140	Install conduit in new position	900	LF	110	99,000
141	Install replacement cable; assumed single cable #12	900	LF	125	112,500
142	Re-commission / testing as required	3	EA	12,500	37,500

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 14TH STREET - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
143	Engineering / Shop Drawings / Etc.	3	EA	7,500	22,500
144	Premium Time	2,353	HRS	49	114,356
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,745)	SF	750	(2,058,750)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	250,185	(250,185)
153	Platform Edge Reconstruction work	(1)	LS	600,200	(600,200)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,340)	LF	30	(40,200)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,169,355	1,169,355
158					
159	**PREMIUM ASSOCIATED WITH PSD's**				**5,067,206**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 14TH STREET - C TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE (C - TRAIN) =	670	LF		
5	LENGTH OF THE PLATFORM EDGE (C - TRAIN) =	670	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,340**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,340	LF	7	9,380
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,700	SF	12	80,400
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	135	CY	2,500	337,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,342	EA	25	33,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,342	EA	25	33,550
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,340	LF	95	127,300
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,340	LF	15	20,100
26	Remove existing platform tiles	1,340	LF	12	16,080
27	Sawcut existing topping concrete at perimeter of removal area	1,340	LF	5	6,700
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,040	SF	8	64,320
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,340	SF	15	20,100

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 14TH STREET - C TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room - C Train [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,745	SF	750	2,058,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	250,185	250,185
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 14TH STREET - C TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,340	LF	60	80,400
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	Allowance for power to cross tracks to opposite platform; 4 Tracks between Platforms	1	LS	35,000	35,000
77	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	1,000	Hrs	160	159,930
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 14TH STREET - C TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	3,945,092	3,945,092
114	TOTAL PSD WORK:				$ 17,095,398

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	5,854	SF	750	4,390,365
127	Spare Parts - Approx. 10% of Material Cost	1	LS	461,542	461,542
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	88,843
130	L6x6x1/2 continuous angle	10	TONS	17,500	172,592
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Platform Edge Repair				
133	Remove concrete platform edge				Previously done
134	Platform edge repair				Previously done
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
136	Signal Work [Each 300' length is associated with one signal light]				
137	Disconnects	80	HRS	162	12,960
138	Remove signal cables	600	LF	40	24,000
139	Remove conduit; Assuming 1"	600	LF	55	33,000
140	Install conduit in new position	600	LF	110	66,000
141	Install replacement cable; assumed single cable #12	600	LF	125	75,000
142	Re-commission / testing as required	2	EA	12,500	25,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: 14TH STREET - C TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
143	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
144	Premium Time	1,569	HRS	49	76,253
145					
146	**OMIT**				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,745)	SF	750	(2,058,750)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	250,185	(250,185)
153	Platform Edge Reconstruction work	(1)	LS	600,200	(600,200)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,340)	LF	30	(40,200)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,120,280	1,120,280
158					
159	**PREMIUM ASSOCIATED WITH PSD's**				**4,854,549**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: WEST 4TH STREET - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE (A - TRAIN) =	660	LF		
5	LENGTH OF THE PLATFORM EDGE (A - TRAIN) =	679	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,339**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,339	LF	7	9,373
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,695	SF	12	80,340
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	135	CY	2,500	337,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,341	EA	25	33,525
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,341	EA	25	33,525
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,339	LF	95	127,205
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,339	LF	15	20,085
26	Remove existing platform tiles	1,339	LF	12	16,068
27	Sawcut existing topping concrete at perimeter of removal area	1,339	LF	5	6,695
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,034	SF	8	64,272
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	780	SF	8	6,240
30	New Work				
31	New concrete topping to match existing	1,339	SF	15	20,085

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: WEST 4TH STREET - A TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	780	SF	15	11,700
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room - A Train [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,741	SF	750	2,055,375
61	Spare Parts - Approx. 10% of Material Cost	1	LS	249,983	249,983
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: WEST 4TH STREET - A TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,339	LF	60	80,340
72	PSD Connections	1	LS	150,000	150,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	Allowance for power to cross tracks to opposite platform [Upper Level]; 4 Tracks between Platforms	1	LS	35,000	35,000
77	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	1,000	Hrs	160	159,930
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: WEST 4TH STREET - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	3,968,147	3,968,147
114	TOTAL PSD WORK:				$ 17,195,305

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	5,846	SF	750	4,384,365
127	Spare Parts - Approx. 10% of Material Cost	1	LS	461,182	461,182
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	88,778
130	L6x6x1/2 continuous angle	10	TONS	17,500	172,463
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Platform Edge Repair				
133	Remove concrete platform edge	660	LF	27	17,820
134	Platform edge repair	660	LF	109	71,940
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
136	Signal Work [Each 300' length is associated with one signal light]				
137	Disconnects				Not Applicable
138	Remove signal cables				Not Applicable
139	Remove conduit; Assuming 1"				Not Applicable
140	Install conduit in new position				Not Applicable
141	Install replacement cable; assumed single cable #12				Not Applicable
142	Re-commission / testing as required				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: WEST 4TH STREET - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
143	Engineering / Shop Drawings / Etc.				Not Applicable
144	Premium Time				Not Applicable
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,741)	SF	750	(2,055,375)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	249,983	(249,983)
153	Platform Edge Reconstruction work	(1)	LS	600,090	(600,090)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,339)	LF	30	(40,170)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,050,161	1,050,161
158					
159	**PREMIUM ASSOCIATED WITH PSD's**				**4,550,700**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: WEST 4TH STREET - C TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE (C - TRAIN) =	660	LF		
5	LENGTH OF THE PLATFORM EDGE (C - TRAIN) =	679	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,339**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,339	LF	7	9,373
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,695	SF	12	80,340
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	135	CY	2,500	337,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,341	EA	25	33,525
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,341	EA	25	33,525
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,339	LF	95	127,205
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,339	LF	15	20,085
26	Remove existing platform tiles	1,339	LF	12	16,068
27	Sawcut existing topping concrete at perimeter of removal area	1,339	LF	5	6,695
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,034	SF	8	64,272
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	780	SF	8	6,240
30	New Work				
31	New concrete topping to match existing	1,339	SF	15	20,085

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: WEST 4TH STREET - C TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	780	SF	15	11,700
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room - C Train [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,741	SF	750	2,055,375
61	Spare Parts - Approx. 10% of Material Cost	1	LS	249,983	249,983
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: WEST 4TH STREET - C TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,339	LF	60	80,340
72	PSD Connections	1	LS	150,000	150,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	Allowance for power to cross tracks to opposite platform [Upper Level]; 4 Tracks between Platforms	1	LS	35,000	35,000
77	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	1,000	Hrs	160	159,930
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: WEST 4TH STREET - C TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	**Training**				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	**Out of hours Work**				
112	Allow loss of production to work at night say 50%	1	LS	3,968,147	3,968,147
114	**TOTAL PSD WORK:**				**$ 17,195,305**

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	5,846	SF	750	4,384,365
127	Spare Parts - Approx. 10% of Material Cost	1	LS	461,182	461,182
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	88,778
130	L6x6x1/2 continuous angle	10	TONS	17,500	172,463
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Platform Edge Repair				
133	Remove concrete platform edge	660	LF	27	17,820
134	Platform edge repair	660	LF	109	71,940
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
136	Signal Work [Each 300' length is associated with one signal light]				
137	Disconnects				Not Applicable
138	Remove signal cables				Not Applicable
139	Remove conduit; Assuming 1"				Not Applicable
140	Install conduit in new position				Not Applicable
141	Install replacement cable; assumed single cable #12				Not Applicable
142	Re-commission / testing as required				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: WEST 4TH STREET - C TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
143	Engineering / Shop Drawings / Etc.				Not Applicable
144	Premium Time				Not Applicable
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,741)	SF	750	(2,055,375)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	249,983	(249,983)
153	Platform Edge Reconstruction work	(1)	LS	600,090	(600,090)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,339)	LF	30	(40,170)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,050,161	1,050,161
158					
159	**PREMIUM ASSOCIATED WITH PSD's**				**4,550,700**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: SPRING STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	660	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,320**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: SPRING STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,655	SF	750	1,991,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	246,135	246,135
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: SPRING STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	400	LF	60	24,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	450	LF	60	27,000
76	Allowance for power to cross tracks to opposite platform; 4 Tracks between Platforms	1	LS	35,000	35,000
77	No allowance for new lighting as if APG's are used		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	1,000	Hrs	160	159,930
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: SPRING STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	**Training**				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	**Out of hours Work**				
112	Allow loss of production to work at night say 50%	1	LS	3,930,725	3,930,725
114	**TOTAL PSD WORK:**				**$ 17,033,141**

116					
117	**ADD ALTERNATIVE**				
118					
119	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
120					
121	**ADD**				
122	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	5,694	SF	750	4,270,365
127	Spare Parts - Approx. 10% of Material Cost	1	LS	454,342	454,342
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
130	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Platform Edge Repair				
133	Remove concrete platform edge	1,320	LF	27	35,640
134	Platform edge repair	1,320	LF	109	143,880
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
136	Signal Work [Each 300' length is associated with one signal light]				
137	Disconnects	80	HRS	162	12,960
138	Remove signal cables	600	LF	40	24,000
139	Remove conduit; Assuming 1"	600	LF	55	33,000
140	Install conduit in new position	600	LF	110	66,000
141	Install replacement cable; assumed single cable #12	600	LF	125	75,000
142	Re-commission / testing as required	2	EA	12,500	25,000
143	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: SPRING STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144	Premium Time	1,569	HRS	49	76,253
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,655)	SF	750	(1,991,250)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,135	(246,135)
153	Platform Edge Reconstruction work	(1)	LS	593,000	(593,000)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,160,585	1,160,585
158					
159	**PREMIUM ASSOCIATED WITH PSD's**				**5,029,201**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: CANAL STREET - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE (A - TRAIN) =	653	LF		
5	LENGTH OF THE PLATFORM EDGE (A - TRAIN) =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,313**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,313	LF	7	9,191
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,565	SF	12	78,780
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	132	CY	2,500	330,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,315	EA	25	32,875
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,315	EA	25	32,875
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,313	LF	95	124,735
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,313	LF	15	19,695
26	Remove existing platform tiles	1,313	LF	12	15,756
27	Sawcut existing topping concrete at perimeter of removal area	1,313	LF	5	6,565
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,878	SF	8	63,024
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,313	SF	15	19,695

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: CANAL STREET - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room - A Train [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,624	SF	750	1,967,625
61	Spare Parts - Approx. 10% of Material Cost	1	LS	244,718	244,718
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: CANAL STREET - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,313	LF	60	78,780
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	Allowance for power to cross tracks to opposite platform	1	LS	35,000	35,000
77	No allowance for new lighting as if APG's are used		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	1,000	Hrs	160	159,930
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: CANAL STREET - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	**Training**				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	**Out of hours Work**				
112	Allow loss of production to work at night say 50%	1	LS	3,910,891	3,910,891
114	**TOTAL PSD WORK:**				**$ 16,947,196**

116					
117	**ADD ALTERNATIVE**				
118					
119	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
120					
121	**ADD**				
122	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
124	Double egress/service gate in the center of the platform; #1 per Platform	4	EA	30,000	120,000
125	Platform End Gates (PEGs)	8	EA	18,000	144,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	5,638	SF	750	4,228,365
127	Spare Parts - Approx. 10% of Material Cost	1	LS	459,742	459,742
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	87,079
130	L6x6x1/2 continuous angle	10	TONS	17,500	169,114
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long	1	LS	350,000	350,000
133	Platform Edge Repair				
134	Remove concrete platform edge				Previously done
135	Platform edge repair				Previously done
136	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
137	Signal Work [Each 300’ length is associated with one signal light]				
138	Disconnects	120	HRS	162	19,440
139	Remove signal cables	900	LF	40	36,000
140	Remove conduit; Assuming 1”	900	LF	55	49,500
141	Install conduit in new position	900	LF	110	99,000
142	Install replacement cable; assumed single cable #12	900	LF	125	112,500
143	Re-commission / testing as required	3	EA	12,500	37,500

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: CANAL STREET - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144	Engineering / Shop Drawings / Etc.	3	EA	7,500	22,500
145	Premium Time	2,353	HRS	49	114,356
146					
147	OMIT				
148	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
149	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
150	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
151	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
152	Fixed Panels including framing and support; 4'-6" High	(2,624)	SF	750	(1,967,625)
153	Spare Parts - Approx. 10% of Material Cost	(1)	LS	244,718	(244,718)
154	Platform Edge Reconstruction work	(1)	LS	589,730	(589,730)
155	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
156	Conduit running under Platform Edge	(1,313)	LF	30	(39,390)
157					
158	Allow loss of production to work at night say 50%	1	LS	1,295,605	1,295,605
159					
160					
161	**PREMIUM ASSOCIATED WITH PSD's**				**5,614,286**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: CANAL STREET - C TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE (A - TRAIN) =	653	LF		
5	LENGTH OF THE PLATFORM EDGE (A - TRAIN) =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,313**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,313	LF	7	9,191
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,565	SF	12	78,780
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	132	CY	2,500	330,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,315	EA	25	32,875
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,315	EA	25	32,875
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,313	LF	95	124,735
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,313	LF	15	19,695
26	Remove existing platform tiles	1,313	LF	12	15,756
27	Sawcut existing topping concrete at perimeter of removal area	1,313	LF	5	6,565
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,878	SF	8	63,024
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,313	SF	15	19,695

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: CANAL STREET - C TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room - A Train [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,624	SF	750	1,967,625
61	Spare Parts - Approx. 10% of Material Cost	1	LS	244,718	244,718
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: CANAL STREET - C TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,313	LF	60	78,780
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	Allowance for power to cross tracks to opposite platform	1	LS	35,000	35,000
77	No allowance for new lighting as if APG's are used		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	1,000	Hrs	160	159,930
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: CANAL STREET - C TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	**Training**				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	**Out of hours Work**				
112	Allow loss of production to work at night say 50%	1	LS	3,910,891	3,910,891
114	**TOTAL PSD WORK:**				**$ 16,947,196**

116					
117	**ADD ALTERNATIVE**				
118					
119	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
120					
121	**ADD**				
122	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
124	Double egress/service gate in the center of the platform; #1 per Platform	4	EA	30,000	120,000
125	Platform End Gates (PEGs)	8	EA	18,000	144,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	5,638	SF	750	4,228,365
127	Spare Parts - Approx. 10% of Material Cost	1	LS	459,742	459,742
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	87,079
130	L6x6x1/2 continuous angle	10	TONS	17,500	169,114
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long	1	LS	350,000	350,000
133	Platform Edge Repair				
134	Remove concrete platform edge				Previously done
135	Platform edge repair				Previously done
136	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
137	Signal Work [Each 300' length is associated with one signal light]				
138	Disconnects	120	HRS	162	19,440
139	Remove signal cables	900	LF	40	36,000
140	Remove conduit; Assuming 1"	900	LF	55	49,500
141	Install conduit in new position	900	LF	110	99,000
142	Install replacement cable; assumed single cable #12	900	LF	125	112,500
143	Re-commission / testing as required	3	EA	12,500	37,500

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION: CANAL STREET - C TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144	Engineering / Shop Drawings / Etc.	3	EA	7,500	22,500
145	Premium Time	2,353	HRS	49	114,356
146					
147	**OMIT**				
148	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
149	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
150	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
151	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
152	Fixed Panels including framing and support; 4'-6" High	(2,624)	SF	750	(1,967,625)
153	Spare Parts - Approx. 10% of Material Cost	(1)	LS	244,718	(244,718)
154	Platform Edge Reconstruction work	(1)	LS	589,730	(589,730)
155	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
156	Conduit running under Platform Edge	(1,313)	LF	30	(39,390)
157					
158	Allow loss of production to work at night say 50%	1	LS	1,295,605	1,295,605
159					
160					
161	**PREMIUM ASSOCIATED WITH PSD's**				**5,614,286**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : FULTON ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	658	LF		
5	LENGTH OF THE PLATFORM EDGE =	658	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,316**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,316	LF	7	9,212
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,580	SF	12	78,960
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,318	EA	25	32,950
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,318	EA	25	32,950
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,316	LF	95	125,020
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,316	LF	15	19,740
26	Remove existing platform tiles	1,316	LF	12	15,792
27	Sawcut existing topping concrete at perimeter of removal area	1,316	LF	5	6,580
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,896	SF	8	63,168
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 22'-0" wide strip	1,280	SF	8	10,240
30	New Work				
31	New concrete topping to match existing	1,316	SF	15	19,740

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : FULTON ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	1,280	SF	15	19,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,637	SF	750	1,977,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	245,325	245,325
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : FULTON ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,316	LF	60	78,960
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	300	LF	60	18,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	350	LF	60	21,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : FULTON ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,911,077	3,911,077
112					
113	TOTAL PSD WORK:				$ 16,948,001
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,662	SF	750	4,246,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	452,902	452,902
127	Structural framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	87,275
129	L6x6x1/2 continuous angle	10	TONS	17,500	169,501
130	Drilling and bolting - 4 bolts at each connection	526	EA	216	113,702
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : FULTON ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,637)	SF	750	(1,977,750)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	245,325	(245,325)
152	Platform Edge Reconstruction work	(1)	LS	592,560	(592,560)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,316)	LF	30	(39,480)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,010,865	1,010,865
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,380,415

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : LAFAYETTE AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	660	LF		
5	LENGTH OF THE PLATFORM EDGE =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,320**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 9'-8" wide	294	SF	8	2,349
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : LAFAYETTE AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	294	SF	15	4,404
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,655	SF	750	1,991,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	246,135	246,135
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : LAFAYETTE AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	600	LF	60	36,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	650	LF	60	39,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : LAFAYETTE AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,919,804	3,919,804
112					
113	TOTAL PSD WORK:				$ 16,985,819
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,694	SF	750	4,270,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	454,342	454,342
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
129	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
130	Drilling and bolting - 4 bolts at each connection	528	EA	216	114,048
131	Platform Edge Repair				
132	Remove concrete platform edge	1,320	LF	27	35,640
133	Platform edge repair	1,320	LF	109	143,880
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Allow for remove and reinstall conductor boxes				Not Applicable
142	Re-commission / testing as required				Not Applicable
143	Engineering / Shop Drawings / Etc.				Not Applicable
144	Premium Time				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : LAFAYETTE AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,655)	SF	750	(1,991,250)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,135	(246,135)
153	Platform Edge Reconstruction work	(1)	LS	593,000	(593,000)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,070,197	1,070,197
158					
159	PREMIUM ASSOCIATED WITH PSD's				$ 4,637,519

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : CLINTON & WASHINGTON AVENUES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
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5	LENGTH OF THE PLATFORM EDGE =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,320**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
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20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 9'-8" wide	294	SF	8	2,349
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : CLINTON & WASHINGTON AVENUES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	294	SF	15	4,404
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,655	SF	750	1,991,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	246,135	246,135
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : CLINTON & WASHINGTON AVENUES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	600	LF	60	36,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	650	LF	60	39,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : CLINTON & WASHINGTON AVENUES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,919,804	3,919,804
112					
113	TOTAL PSD WORK:				$ 16,985,819
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,694	SF	750	4,270,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	454,342	454,342
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
129	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
130	Drilling and bolting - 4 bolts at each connection	528	EA	216	114,048
131	Platform Edge Repair				
132	Remove concrete platform edge	1,320	LF	27	35,640
133	Platform edge repair	1,320	LF	109	143,880
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : CLINTON & WASHINGTON AVENUES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,655)	SF	750	(1,991,250)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,135	(246,135)
152	Platform Edge Reconstruction work	(1)	LS	593,000	(593,000)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,070,197	1,070,197
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,637,519

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : FRANKLIN AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	662	LF		
5	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	662	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,324**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,324	LF	7	9,268
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,620	SF	12	79,440
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,326	EA	25	33,150
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,326	EA	25	33,150
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,324	LF	95	125,780
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,324	LF	15	19,860
26	Remove existing platform tiles	1,324	LF	12	15,888
27	Sawcut existing topping concrete at perimeter of removal area	1,324	LF	5	6,620
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,944	SF	8	63,552
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 9'-8" wide	294	SF	8	2,349
30	New Work				
31	New concrete topping to match existing	1,324	SF	15	19,860
32	New concrete topping at ADA boarding area to match existing	294	SF	15	4,404

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : FRANKLIN AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,673	SF	750	2,004,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	246,945	246,945
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
71	Allow for conduit / cable runs for power and communications under platform edge	1,324	LF	60	79,440

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : FRANKLIN AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
74	Power to PSD Room from EDR including track crossing if needed	750	LF	60	45,000
75	Reserve power to PSD Room from EDR including track crossing if needed	800	LF	60	48,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	25,000	25,000
79	MISC				
80	Testing and commissioning	1	LS	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : FRANKLIN AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,929,938	3,929,938
113	TOTAL PSD WORK:				$ 17,029,731

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,726	SF	750	4,294,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	455,782	455,782
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	87,798
129	L6x6x1/2 continuous angle	10	TONS	17,500	170,531
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Platform Edge Repair				
132	Remove concrete platform edge	1,324	LF	27	35,748
133	Platform edge repair	1,324	LF	109	144,316
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : FRANKLIN AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,673)	SF	750	(2,004,750)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,945	(246,945)
152	Platform Edge Reconstruction work	(1)	LS	593,440	(593,440)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,324)	LF	30	(39,720)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,065,988	1,065,988
157					
158	PREMIUM ASSOCIATED WITH PSD's				4,619,281

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : NOSTRAND AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE UPPER PLATFORM EDGE [SOUTH BOUND] =	660	LF		
5	LENGTH OF THE LOWER PLATFORM EDGE [NORTH BOUND] =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,320**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 24'-10" wide strip	1,658	SF	8	13,263
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : NOSTRAND AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	1,658	SF	15	24,869
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,655	SF	750	1,991,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	246,135	246,135
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : NOSTRAND AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	400	LF	60	24,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	450	LF	60	27,000
76	Allowance for power to cross tracks to opposite platform [Upper level]	1	LS	15,000	15,000
77	Allowance for power to cross tracks to opposite platform [Lower level]	1	LS	15,000	15,000
78	No allowance for new lighting as if APG's are used		Note		EXCL.
79	Grounding				
80	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
81	MISC				
82	Testing and commissioning	1	EA	30,000	30,000
83	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
84					
85	**Communications**				
86	FA System				
87	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
88	CCTV coverage				
89	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
90	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
91	Berthing Technology Sensors				
92	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
93	Train Door Detection System				
94	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
95	Entrapment concerns				
96	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
97	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
98	Engineering and Testing	1,000	Hrs	160	159,930
99	Centralized monitoring/control				
100	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : NOSTRAND AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
101	MISC				
102	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
103	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
104	Site Survey and Inspections	1	LS	100,000	100,000
105	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
106	Furnish Test Equipment allowance	1	LS	500,000	500,000
107	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
108					
109	**Training**				
110	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
111					
112	**Out of hours Work**				
113	Allow loss of production to work at night say 50%	1	LS	3,931,018	3,931,018
115	TOTAL PSD WORK:				$ 17,034,412

117					
118	ADD ALTERNATIVE				
119					
120	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
121					
122	**ADD**				
123	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
124	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
125	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
126	Platform End Gates (PEGs)	4	EA	18,000	72,000
127	Fixed Panels including framing and support; Assuming 8'-0" high	5,694	SF	750	4,270,365
128	Spare Parts - Approx. 10% of Material Cost	1	LS	454,342	454,342
129	Structual framing / bracing				
130	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
131	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
132	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
133	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long	1	LS	350,000	350,000
134	Platform Edge Repair				
135	Remove concrete platform edge	1,320	LF	27	35,640
136	Platform edge repair	1,320	LF	109	143,880
137	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
138	Signal Work [Each 300' length is associated with one signal light]				
139	Disconnects	160	HRS	162	25,920
140	Remove signal cables	1,200	LF	40	48,000
141	Remove conduit; Assuming 1”	1,200	LF	55	66,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : NOSTRAND AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Install conduit in new position	1,200	LF	110	132,000
143	Install replacement cable; assumed single cable #12	1,200	LF	125	150,000
144	Re-commission / testing as required	4	EA	12,500	50,000
145	Engineering / Shop Drawings / Etc.	4	EA	7,500	30,000
146	Premium Time	3,137	HRS	49	152,458
147					
148	OMIT				
149	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
150	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
151	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
152	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
153	Fixed Panels including framing and support; 4'-6" High	(2,655)	SF	750	(1,991,250)
154	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,135	(246,135)
155	Platform Edge Reconstruction work	(1)	LS	593,000	(593,000)
156	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
157	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
158					
159	Allow loss of production to work at night say 50%	1	LS	1,363,734	1,363,734
160					
161					
162	**PREMIUM ASSOCIATED WITH PSD's**				**5,909,515**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : KINGSTON THROOP AVENUES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	660	LF		
5	LENGTH OF THE PLATFORM EDGE =	618	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,278**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,278	LF	7	8,946
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,390	SF	12	76,680
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	129	CY	2,500	322,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,280	EA	25	32,000
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,280	EA	25	32,000
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,278	LF	95	121,410
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,278	LF	15	19,170
26	Remove existing platform tiles	1,278	LF	12	15,336
27	Sawcut existing topping concrete at perimeter of removal area	1,278	LF	5	6,390
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,668	SF	8	61,344
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 9'-8" wide strip	294	SF	8	2,349
30	New Work				
31	New concrete topping to match existing	1,278	SF	15	19,170

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : KINGSTON THROOP AVENUES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	294	SF	15	4,404
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,466	SF	750	1,849,500
61	Spare Parts - Approx. 10% of Material Cost	1	LS	237,630	237,630
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : KINGSTON THROOP AVENUES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,278	LF	60	76,680
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	450	LF	60	27,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	500	LF	60	30,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : KINGSTON THROOP AVENUES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,861,704	3,861,704
112					
113	**TOTAL PSD WORK:**				**$ 16,734,049**
115					
116	**ADD ALTERNATIVE**				
117					
118	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
119					
120	**ADD**				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,358	SF	750	4,018,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	439,222	439,222
127	Structural framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	84,793
129	L6x6x1/2 continuous angle	9	TONS	17,500	164,606
130	Drilling and bolting - 4 bolts at each connection	511	EA	216	110,419
131	Platform Edge Repair				
132	Remove concrete platform edge	1,278	LF	27	34,506
133	Platform edge repair	1,278	LF	109	139,302
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : KINGSTON THROOP AVENUES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,466)	SF	750	(1,849,500)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	237,630	(237,630)
152	Platform Edge Reconstruction work	(1)	LS	578,380	(578,380)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,278)	LF	30	(38,340)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,034,653	1,034,653
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,483,496

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : UTICA AVENUE - A Train

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE (A Train side) =	610	LF		
5	LENGTH OF THE PLATFORM EDGE (A Train side) =	610	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,220**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,220	LF	7	8,540
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,100	SF	12	73,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	123	CY	2,500	307,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,222	EA	25	30,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,222	EA	25	30,550
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,220	LF	95	115,900
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,220	LF	15	18,300
26	Remove existing platform tiles	1,220	LF	12	14,640
27	Sawcut existing topping concrete at perimeter of removal area	1,220	LF	5	6,100
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,320	SF	8	58,560
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 27'-8" wide	1,734	SF	8	13,869
30	New Work				
31	New concrete topping to match existing	1,220	SF	15	18,300

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : UTICA AVENUE - A Train

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	1,734	SF	15	26,004
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room - A train [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,205	SF	750	1,653,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	225,885	225,885
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : UTICA AVENUE - A Train

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,220	LF	60	73,200
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	500	LF	60	30,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	550	LF	60	33,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : UTICA AVENUE - A Train

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,800,305	3,800,305
112					
113	TOTAL PSD WORK:				$ 16,467,990
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,894	SF	750	3,670,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	418,342	418,342
127	Structural framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,004
129	L6x6x1/2 continuous angle	9	TONS	17,500	157,136
130	Drilling and bolting - 4 bolts at each connection	488	EA	216	105,408
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	80	HRS	162	12,960
137	Remove signal cables	600	LF	40	24,000
138	Remove conduit; Assuming 1"	600	LF	55	33,000
139	Install conduit in new position	600	LF	110	66,000
140	Install replacement cable; assumed single cable #12	600	LF	125	75,000
141	Allow for remove and reinstall conductor boxes	2	EA	3,000	6,000
142	Re-commission / testing as required	2	EA	12,500	25,000
143	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
144	Premium Time	1,606	HRS	49	78,052

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : UTICA AVENUE - A Train

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,205)	SF	750	(1,653,750)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	225,885	(225,885)
153	Platform Edge Reconstruction work	(1)	LS	557,000	(557,000)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,220)	LF	30	(36,600)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,034,685	1,034,685
158					
159	PREMIUM ASSOCIATED WITH PSD's				$ 4,483,637

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : UTICA AVENUE - C Train

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE (C Train side) =	610	LF		
5	LENGTH OF THE PLATFORM EDGE (C Train side) =	610	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,220**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,220	LF	7	8,540
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,100	SF	12	73,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	123	CY	2,500	307,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,222	EA	25	30,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,222	EA	25	30,550
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,220	LF	95	115,900
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,220	LF	15	18,300
26	Remove existing platform tiles	1,220	LF	12	14,640
27	Sawcut existing topping concrete at perimeter of removal area	1,220	LF	5	6,100
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,320	SF	8	58,560
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 27'-8" wide	1,734	SF	8	13,869
30	New Work				
31	New concrete topping to match existing	1,220	SF	15	18,300

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : UTICA AVENUE - C Train

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	1,734	SF	15	26,004
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room - C train [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,205	SF	750	1,653,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	225,885	225,885
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : UTICA AVENUE - C Train

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,220	LF	60	73,200
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	500	LF	60	30,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	550	LF	60	33,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : UTICA AVENUE - C Train

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,800,305	3,800,305
112					
113	TOTAL PSD WORK:				$ 16,467,990
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,894	SF	750	3,670,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	418,342	418,342
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,004
129	L6x6x1/2 continuous angle	9	TONS	17,500	157,136
130	Drilling and bolting - 4 bolts at each connection	488	EA	216	105,408
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	80	HRS	162	12,960
137	Remove signal cables	600	LF	40	24,000
138	Remove conduit; Assuming 1"	600	LF	55	33,000
139	Install conduit in new position	600	LF	110	66,000
140	Install replacement cable; assumed single cable #12	600	LF	125	75,000
141	Allow for remove and reinstall conductor boxes	2	EA	3,000	6,000
142	Re-commission / testing as required	2	EA	12,500	25,000
143	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
144	Premium Time	1,606	HRS	49	78,052

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : UTICA AVENUE - C Train

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,205)	SF	750	(1,653,750)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	225,885	(225,885)
153	Platform Edge Reconstruction work	(1)	LS	557,000	(557,000)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,220)	LF	30	(36,600)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,034,685	1,034,685
158					
159	PREMIUM ASSOCIATED WITH PSD's				$ 4,483,637

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : RALPH AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	660	LF		
5	LENGTH OF THE PLATFORM EDGE =	618	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,278**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,278	LF	7	8,946
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,390	SF	12	76,680
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	129	CY	2,500	322,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,280	EA	25	32,000
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,280	EA	25	32,000
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,278	LF	95	121,410
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,278	LF	15	19,170
26	Remove existing platform tiles	1,278	LF	12	15,336
27	Sawcut existing topping concrete at perimeter of removal area	1,278	LF	5	6,390
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,668	SF	8	61,344
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 9'-8" wide strip	294	SF	8	2,349
30	New Work				
31	New concrete topping to match existing	1,278	SF	15	19,170

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : RALPH AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	294	SF	15	4,404
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,466	SF	750	1,849,500
61	Spare Parts - Approx. 10% of Material Cost	1	LS	237,630	237,630
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : RALPH AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,278	LF	60	76,680
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	250	LF	60	15,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	300	LF	60	18,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : RALPH AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,854,504	3,854,504
112					
113	TOTAL PSD WORK:				$ 16,702,849
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,358	SF	750	4,018,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	439,222	439,222
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	84,793
129	L6x6x1/2 continuous angle	9	TONS	17,500	164,606
130	Drilling and bolting - 4 bolts at each connection	511	EA	216	110,419
131	Platform Edge Repair				
132	Remove concrete platform edge	1,278	LF	27	34,506
133	Platform edge repair	1,278	LF	109	139,302
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : RALPH AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,466)	SF	750	(1,849,500)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	237,630	(237,630)
152	Platform Edge Reconstruction work	(1)	LS	578,380	(578,380)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,278)	LF	30	(38,340)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,034,653	1,034,653
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				**$ 4,483,496**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : ROCKAWAY AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	704	LF		
5	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	704	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,408**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,408	LF	7	9,856
14	Remove 5' wide section of 3" deep structural slab to platform edge	7,040	SF	12	84,480
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	142	CY	2,500	355,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,410	EA	25	35,250
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,410	EA	25	35,250
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,408	LF	95	133,760
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,408	LF	15	21,120
26	Remove existing platform tiles	1,408	LF	12	16,896
27	Sawcut existing topping concrete at perimeter of removal area	1,408	LF	5	7,040
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,448	SF	8	67,584
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 9'-4" wide	266	SF	8	2,131
30	New Work				
31	New concrete topping to match existing	1,408	SF	15	21,120
32	New concrete topping at ADA boarding area to match existing	266	SF	15	3,996

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : ROCKAWAY AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	3,051	SF	750	2,288,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	263,955	263,955
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
71	Allow for conduit / cable runs for power and communications under platform edge	1,408	LF	60	84,480

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : ROCKAWAY AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
74	Power to PSD Room from EDR including track crossing if needed	100	LF	60	6,000
75	Reserve power to PSD Room from EDR including track crossing if needed	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
79	MISC				
80	Testing and commissioning	1	LS	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : ROCKAWAY AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	4,011,002	4,011,002
113	TOTAL PSD WORK:				$ 17,381,007

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	6,398	SF	750	4,798,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	486,022	486,022
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	93,285
129	L6x6x1/2 continuous angle	10	TONS	17,500	181,350
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Platform Edge Repair				
132	Remove concrete platform edge	1,408	LF	27	38,016
133	Platform edge repair	1,408	LF	109	153,472
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : ROCKAWAY AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(3,051)	SF	750	(2,288,250)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	263,955	(263,955)
152	Platform Edge Reconstruction work	(1)	LS	625,180	(625,180)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,408)	LF	30	(42,240)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,134,148	1,134,148
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				**4,914,642**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BROADWAY JCT/EAST NY - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [A - TRAIN] =	610	LF		
5	LENGTH OF THE PLATFORM EDGE [A - TRAIN] =	610	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,220**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,220	LF	7	8,540
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,100	SF	12	73,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	123	CY	2,500	307,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,222	EA	25	30,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,222	EA	25	30,550
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,220	LF	95	115,900
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,220	LF	15	18,300
26	Remove existing platform tiles	1,220	LF	12	14,640
27	Sawcut existing topping concrete at perimeter of removal area	1,220	LF	5	6,100
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,320	SF	8	58,560
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 21'-6" wide strip	1,364	SF	8	10,912
30	New Work				
31	New concrete topping to match existing	1,220	SF	15	18,300

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BROADWAY JCT/EAST NY - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	1,364	SF	15	20,460
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room - A Train [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,205	SF	750	1,653,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	225,885	225,885
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BROADWAY JCT/EAST NY - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,220	LF	60	73,200
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	400	LF	60	24,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	450	LF	60	27,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BROADWAY JCT/EAST NY - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,794,155	3,794,155
113	TOTAL PSD WORK:				$ 16,441,339

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,894	SF	750	3,670,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	418,342	418,342
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,004
129	L6x6x1/2 continuous angle	9	TONS	17,500	157,136
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long	1	LS	350,000	350,000
132	Platform Edge Repair				
133	Remove concrete platform edge				Previously done
134	Platform edge repair				Previously done
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
136	Signal Work [Each 300' length is associated with one signal light]				
137	Disconnects				Not Applicable
138	Remove signal cables				Not Applicable
139	Remove conduit; Assuming 1"				Not Applicable
140	Install conduit in new position				Not Applicable
141	Install replacement cable; assumed single cable #12				Not Applicable
142	Re-commission / testing as required				Not Applicable
143	Engineering / Shop Drawings / Etc.				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BROADWAY JCT/EAST NY - A TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144	Premium Time				Not Applicable
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,205)	SF	750	(1,653,750)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	225,885	(225,885)
153	Platform Edge Reconstruction work	(1)	LS	557,000	(557,000)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,220)	LF	30	(36,600)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,033,998	1,033,998
158					
159					
160	**PREMIUM ASSOCIATED WITH PSD's**				**4,480,658**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BROADWAY JCT/EAST NY - C TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [C - TRAIN] =	610	LF		
5	LENGTH OF THE PLATFORM EDGE [C - TRAIN] =	610	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,220	LF		
7	NUMBER OF TRAIN CARS ON THIS LINE =	10	CARS		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,220	LF	7	8,540
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,100	SF	12	73,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	123	CY	2,500	307,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,222	EA	25	30,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,222	EA	25	30,550
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,220	LF	95	115,900
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,220	LF	15	18,300
26	Remove existing platform tiles	1,220	LF	12	14,640
27	Sawcut existing topping concrete at perimeter of removal area	1,220	LF	5	6,100
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,320	SF	8	58,560
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 21'-6" wide strip	1,364	SF	8	10,912
30	New Work				
31	New concrete topping to match existing	1,220	SF	15	18,300

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BROADWAY JCT/EAST NY - C TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	1,364	SF	15	20,460
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room - C Train [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,205	SF	750	1,653,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	225,885	225,885
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BROADWAY JCT/EAST NY - C TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,220	LF	60	73,200
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	400	LF	60	24,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	450	LF	60	27,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BROADWAY JCT/EAST NY - C TRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,794,155	3,794,155
113	**TOTAL PSD WORK:**				**$ 16,441,339**

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
115					
116	**ADD ALTERNATIVE**				
117					
118	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
119					
120	**ADD**				
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,894	SF	750	3,670,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	418,342	418,342
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,004
129	L6x6x1/2 continuous angle	9	TONS	17,500	157,136
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long	1	LS	350,000	350,000
132	Platform Edge Repair				
133	Remove concrete platform edge				Previously done
134	Platform edge repair				Previously done
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
136	Signal Work [Each 300' length is associated with one signal light]				
137	Disconnects				Not Applicable
138	Remove signal cables				Not Applicable
139	Remove conduit; Assuming 1"				Not Applicable
140	Install conduit in new position				Not Applicable
141	Install replacement cable; assumed single cable #12				Not Applicable
142	Re-commission / testing as required				Not Applicable
143	Engineering / Shop Drawings / Etc.				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BROADWAY JCT/EAST NY - C TRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144	Premium Time				Not Applicable
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,205)	SF	750	(1,653,750)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	225,885	(225,885)
153	Platform Edge Reconstruction work	(1)	LS	557,000	(557,000)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,220)	LF	30	(36,600)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,033,998	1,033,998
158					
159					
160	**PREMIUM ASSOCIATED WITH PSD's**				**4,480,658**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : LIBERTY AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	610	LF		
5	LENGTH OF THE PLATFORM EDGE =	610	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,220**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,220	LF	7	8,540
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,100	SF	12	73,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	123	CY	2,500	307,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,222	EA	25	30,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,222	EA	25	30,550
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,220	LF	95	115,900
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,220	LF	15	18,300
26	Remove existing platform tiles	1,220	LF	12	14,640
27	Sawcut existing topping concrete at perimeter of removal area	1,220	LF	5	6,100
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,320	SF	8	58,560
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 9'-8" wide strip	294	SF	8	2,349
30	New Work				
31	New concrete topping to match existing	1,220	SF	15	18,300

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : LIBERTY AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	294	SF	15	4,404
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,205	SF	750	1,653,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	225,885	225,885
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : LIBERTY AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,220	LF	60	73,200
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : LIBERTY AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,775,969	3,775,969
112					
113	TOTAL PSD WORK:				$ 16,362,534
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,894	SF	750	3,670,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	418,342	418,342
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,004
129	L6x6x1/2 continuous angle	9	TONS	17,500	157,136
130	Drilling and bolting - 4 bolts at each connection	488	EA	216	105,408
131	Platform Edge Repair				
132	Remove concrete platform edge	1,222	LF	27	32,994
133	Platform edge repair	1,222	LF	109	133,198
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : LIBERTY AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,205)	SF	750	(1,653,750)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	225,885	(225,885)
152	Platform Edge Reconstruction work	(1)	LS	557,000	(557,000)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,220)	LF	30	(36,600)
155					
156	Allow loss of production to work at night say 50%	1	LS	986,008	986,008
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,272,699

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : VAN SICLEN AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	598	LF		
5	LENGTH OF THE PLATFORM EDGE =	598	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,196	LF		
7	NUMBER OF TRAIN CARS ON THIS LINE =	10	CARS		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,196	LF	7	8,370
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,978	SF	12	71,741
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	120	CY	2,500	300,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,198	EA	25	29,942
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,198	EA	25	29,942
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,196	LF	95	113,590
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,196	LF	15	17,935
26	Remove existing platform tiles	1,196	LF	12	14,348
27	Sawcut existing topping concrete at perimeter of removal area	1,196	LF	5	5,978
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,174	SF	8	57,393
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 9'-8" wide strip	294	SF	8	2,349
30	New Work				
31	New concrete topping to match existing	1,196	SF	15	17,935

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : VAN SICLEN AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	294	SF	15	4,404
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,096	SF	750	1,571,670
61	Spare Parts - Approx. 10% of Material Cost	1	LS	220,960	220,960
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : VAN SICLEN AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,196	LF	60	71,741
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : VAN SICLEN AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,744,940	3,744,940
112					
113	**TOTAL PSD WORK:**				**$ 16,228,075**
115					
116	**ADD ALTERNATIVE**				
117					
118	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
119					
120	**ADD**				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,699	SF	750	3,524,445
126	Spare Parts - Approx. 10% of Material Cost	1	LS	409,587	409,587
127	Structural framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	79,415
129	L6x6x1/2 continuous angle	9	TONS	17,500	154,004
130	Drilling and bolting - 4 bolts at each connection	478	EA	216	103,307
131	Platform Edge Repair				
132	Remove concrete platform edge	1,198	LF	27	32,337
133	Platform edge repair	1,198	LF	109	130,547
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : VAN SICLEN AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,096)	SF	750	(1,571,670)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	220,960	(220,960)
152	Platform Edge Reconstruction work	(1)	LS	546,825	(546,825)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,196)	LF	30	(35,870)
155					
156	Allow loss of production to work at night say 50%	1	LS	965,939	965,939
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,185,735

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : SHEPHERD AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	610	LF		
5	LENGTH OF THE PLATFORM EDGE =	610	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,220**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,220	LF	7	8,537
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,098	SF	12	73,170
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	123	CY	2,500	307,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,222	EA	25	30,538
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,222	EA	25	30,538
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,220	LF	95	115,853
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,220	LF	15	18,293
26	Remove existing platform tiles	1,220	LF	12	14,634
27	Sawcut existing topping concrete at perimeter of removal area	1,220	LF	5	6,098
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,317	SF	8	58,536
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 11'-2" wide	413	SF	8	3,302
30	New Work				
31	New concrete topping to match existing	1,220	SF	15	18,293

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : SHEPHERD AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	413	SF	15	6,192
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,203	SF	750	1,652,063
61	Spare Parts - Approx. 10% of Material Cost	1	LS	225,784	225,784
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : SHEPHERD AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,220	LF	60	73,170
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : SHEPHERD AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,776,200	3,776,200
112					
113	**TOTAL PSD WORK:**				**$ 16,363,534**
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,890	SF	750	3,667,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	418,162	418,162
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	80,971
129	L6x6x1/2 continuous angle	9	TONS	17,500	157,072
130	Drilling and bolting - 4 bolts at each connection	488	EA	216	105,365
131	Platform Edge Repair				
132	Remove concrete platform edge	1,222	LF	27	32,981
133	Platform edge repair	1,222	LF	109	133,144
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : SHEPHERD AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,203)	SF	750	(1,652,063)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	225,784	(225,784)
152	Platform Edge Reconstruction work	(1)	LS	556,945	(556,945)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,220)	LF	30	(36,585)
155					
156	Allow loss of production to work at night say 50%	1	LS	985,549	985,549
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,270,711

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : AQUEDUCT RACE TRACK

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE =	689	LF		
5	TOTAL LENGTH OF THE PLATFORM EDGE =	**689**	**LF**		
6	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
7					
8	**AUTOMATIC PLATFORM GATES [APG's]**				
9					
10	**Platform edge reconstruction**				
11	Demolition				
12	Remove existing polyethylene edge strip	689	LF	7	4,823
13	Remove 5' wide section of 3" deep structural slab to platform edge	3,445	SF	12	41,340
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	70	CY	2,500	175,000
16	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	691	EA	25	17,275
17	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	691	EA	25	17,275
18	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
19	Polyethylene edge strip	689	LF	95	65,455
20	Provide sleeves for HV & LV wires	328	EA	110	36,080
21					
22	**Platform edge finishes**				
23	Demolition				
24	Remove existing tactile warning strip 2' wide	689	LF	15	10,335
25	Remove existing platform tiles	689	LF	12	8,268
26	Sawcut existing topping concrete at perimeter of removal area	689	LF	5	3,445
27	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	4,134	SF	8	33,072
28	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 43'-8" wide	3,014	SF	8	24,109
29	New Work				
30	New concrete topping to match existing	689	SF	15	10,335
31	New concrete topping at ADA boarding area to match existing	3,014	SF	15	45,204

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : AQUEDUCT RACE TRACK

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	240	LF	110	26,400
33	Misc. patchwork	1	LS	50,000	50,000
34					
35	**Equipment Room [7'-0" x 27'-0"]**				
36	Build off existing mezzanine slab		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
38	CMU Wall for equipment room	410	SF	45	18,450
39	Vertical connections with existing structure	20	LF	25	500
40	Roof for equipment room	189	SF	30	5,670
41	Fire rated door including frame & hardware	1	EA	2,500	2,500
42	Exterior wall finish				
43	Ceramic Tiling to match existing	410	SF	40	16,400
44	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
45	Concrete cove to match existing	41	LF	20	820
46	Interior Wall Finish - Paint	680	SF	5	3,400
47	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
48	Allow for 4" thick concrete pads for equipment	47	SF	20	945
49	Allowance for Mechanical Scope	1	LS	40,000	40,000
50	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
51	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
52	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
53					
54	**Automatic Platform Gates [APGs] - 4'-6" High**				
55	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	40	EA	15,000	600,000
56	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	39	EA	10,500	409,500
57	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
58	Platform End Gates (PEGs)	4	EA	13,000	52,000
59	Fixed Panels including framing and support; 4'-6" High	1,815	SF	750	1,361,273
60	Spare Parts - Approx. 10% of Material Cost	1	LS	147,766	147,766
61	Testing and commissioning	800	HRS	160	127,944
62	Product Warranty	1	LS	500,000	500,000
63	Allowance for Braille Signage	40	EA	2,500	100,000
64					
65	**Electrical**				
66	Electrical Upgrades				
67	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
68	Power and Lighting				
69	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
70	Allow for conduit / cable runs for power and communications under platform edge	689	LF	60	41,340

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : AQUEDUCT RACE TRACK

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
	PSD Connections	1	LS	75,000	75,000
72	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
73	Power to PSD Room from EDR including track crossing if needed	150	LF	60	9,000
74	Reserve power to PSD Room from EDR including track crossing if needed	200	LF	60	12,000
75	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
76	Grounding				
77	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
78	MISC				
79	Testing and commissioning	1	LS	30,000	30,000
80	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
81					
82	**Communications**				
83	FA System				
84	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
85	CCTV coverage				
86	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
87	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
88	Berthing Technology Sensors				
89	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
90	Train Door Detection System				
91	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
92	Entrapment concerns				
93	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	120	EA	4,629	555,509
94	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	120	EA	5,566	667,868
95	Engineering and Testing	1,000	Hrs	160	159,930
96	Centralized monitoring/control				
97	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
98	MISC				
99	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
100	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
101	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : AQUEDUCT RACE TRACK

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
103	Furnish Test Equipment allowance	1	LS	500,000	500,000
104	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
105					
106	Training				
107	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
108					
109	Out of hours Work				
110	Allow loss of production to work at night say 50%	1	LS	2,727,863	2,727,863
112	TOTAL PSD WORK:				$ 11,820,738

114					
115	ADD ALTERNATIVE				
116					
117	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
118					
119	ADD				
120	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
121	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
122	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
123	Platform End Gates (PEGs)				Not Applicable
124	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
125	Spare Parts - Approx. 10% of Material Cost				Not Applicable
126	Structual framing / bracing				
127	HSS4x4x1/2 hanger				Not Applicable
128	L6x6x1/2 continuous angle				Not Applicable
129	Drilling and bolting - 4 bolts at each connection				Not Applicable
130	Platform Edge Repair				
131	Remove concrete platform edge				Not Applicable
132	Platform edge repair				Not Applicable
133	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Not Applicable
134	Signal Work [Each 300' length is associated with one signal light]				
135	Disconnects				Not Applicable
136	Remove signal cables				Not Applicable
137	Remove conduit; Assuming 1"				Not Applicable
138	Install conduit in new position				Not Applicable
139	Install replacement cable; assumed single cable #12				Not Applicable
140	Re-commission / testing as required				Not Applicable
141	Engineering / Shop Drawings / Etc.				Not Applicable
142	Premium Time				Not Applicable
143					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : AQUEDUCT RACE TRACK

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
144	OMIT				
145	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
146	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
147	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
148	Platform End Gates (PEGs)				Not Applicable
149	Fixed Panels including framing and support; 4'-6" High				Not Applicable
150	Spare Parts - Approx. 10% of Material Cost				Not Applicable
151	Platform Edge Reconstruction work				Not Applicable
152	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
153	Conduit running under Platform Edge				Not Applicable
154					
155	Allow loss of production to work at night say 50%	1	LS	-	-
156					
157	**PREMIUM ASSOCIATED WITH PSD's**				-

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : AQUEDUCT NORTH CONDUIT AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	820	LF		
5	LENGTH OF THE PLATFORM EDGE =	820	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,639**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,639	LF	7	11,474
14	Remove 5' wide section of 3" deep structural slab to platform edge	8,196	SF	12	98,350
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	165	CY	2,500	412,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,641	EA	25	41,029
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,641	EA	25	41,029
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,639	LF	95	155,720
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,639	LF	15	24,587
26	Remove existing platform tiles	1,639	LF	12	19,670
27	Sawcut existing topping concrete at perimeter of removal area	1,639	LF	5	8,196
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	9,835	SF	8	78,680
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-0" wide strip	440	SF	8	3,520
30	New Work				
31	New concrete topping to match existing	1,639	SF	15	24,587

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : AQUEDUCT NORTH CONDUIT AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	440	SF	15	6,600
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	4,190	SF	750	3,142,665
61	Spare Parts - Approx. 10% of Material Cost	1	LS	315,220	315,220
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : AQUEDUCT NORTH CONDUIT AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,639	LF	60	98,350
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	550	LF	60	33,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	600	LF	60	36,000
76	Allowance for power to cross tracks to opposite platform [Upper level]	1	LS	15,000	15,000
77	Allowance for power to cross tracks to opposite platform [Lower level]	1	LS	15,000	15,000
78	No allowance for new lighting as if APG's are used		Note		EXCL.
79	Grounding				
80	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
81	MISC				
82	Testing and commissioning	1	EA	30,000	30,000
83	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
84					
85	**Communications**				
86	FA System				
87	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
88	CCTV coverage				
89	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
90	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
91	Berthing Technology Sensors				
92	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
93	Train Door Detection System				
94	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
95	Entrapment concerns				
96	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
97	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
98	Engineering and Testing	1,000	Hrs	160	159,930
99	Centralized monitoring/control				
100	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : AQUEDUCT NORTH CONDUIT AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
101	MISC				
102	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
103	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
104	Site Survey and Inspections	1	LS	100,000	100,000
105	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
106	Furnish Test Equipment allowance	1	LS	500,000	500,000
107	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
108					
109	Training				
110	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
111					
112	Out of hours Work				
113	Allow loss of production to work at night say 50%	1	LS	4,353,304	4,353,304
115	TOTAL PSD WORK:				$ 18,864,318

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
117					
118	ADD ALTERNATIVE				
119					
120	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
121					
122	ADD				
123	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
124	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
125	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
126	Platform End Gates (PEGs)				Not Applicable
127	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
128	Spare Parts - Approx. 10% of Material Cost				Not Applicable
129	Structual framing / bracing				
130	HSS4x4x1/2 hanger				Not Applicable
131	L6x6x1/2 continuous angle				Not Applicable
132	Drilling and bolting - 4 bolts at each connection				Not Applicable
133	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long				
134	Platform Edge Repair				Not Applicable
135	Remove concrete platform edge				Not Applicable
136	Platform edge repair				Not Applicable
137	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				
138	Signal Work [Each 300' length is associated with one signal light]				Not Applicable
139	Disconnects				Not Applicable
140	Remove signal cables				Not Applicable
141	Remove conduit; Assuming 1”				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : AQUEDUCT NORTH CONDUIT AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Install conduit in new position				Not Applicable
143	Install replacement cable; assumed single cable #12				Not Applicable
144	Re-commission / testing as required				Not Applicable
145	Engineering / Shop Drawings / Etc.				Not Applicable
146	Premium Time				
147					
148	OMIT				Not Applicable
149	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
150	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
151	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
152	Platform End Gates (PEGs)				Not Applicable
153	Fixed Panels including framing and support; 4'-6" High				Not Applicable
154	Spare Parts - Approx. 10% of Material Cost				Not Applicable
155	Platform Edge Reconstruction work				Not Applicable
156	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
157	Conduit running under Platform Edge				Not Applicable
158					
159	Allow loss of production to work at night say 50%	1	LS	-	-
160					
161					
162	**PREMIUM ASSOCIATED WITH PSD's**				-

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : HOWARD BEACH AIRTRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	692	LF		
5	LENGTH OF THE PLATFORM EDGE =	692	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,384**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,384	LF	7	9,688
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,920	SF	12	83,040
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	139	CY	2,500	347,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,386	EA	25	34,650
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,386	EA	25	34,650
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,384	LF	95	131,480
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,384	LF	15	20,760
26	Remove existing platform tiles	1,384	LF	12	16,608
27	Sawcut existing topping concrete at perimeter of removal area	1,384	LF	5	6,920
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,304	SF	8	66,432
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 11'-4" wide strip	426	SF	8	3,411
30	New Work				
31	New concrete topping to match existing	1,384	SF	15	20,760

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : HOWARD BEACH AIRTRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	426	SF	15	6,396
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Platform column restructuring**				
37	Demolition				
38	Install, maintain and remove temporary support	2	LS	15,000	30,000
39	Breakout existing platform slab for new column	2	LS	5,000	10,000
40	New Work				
41	Excavate for foundation for new column	2	EA	1,500	3,000
42	Foundation for new column	2	EA	5,000	10,000
43	New structural steel column	2	EA	20,000	40,000
44	Extend and repair beams above	2	LS	5,000	10,000
45	Grillage	2	EA	10,000	20,000
46					
47	**Equipment Room [7'-0" x 27'-0"]**				
48	Build off existing mezzanine slab		Note		
49	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
50	CMU Wall for equipment room	410	SF	45	18,450
51	Vertical connections with existing structure	20	LF	25	500
52	Roof for equipment room	189	SF	30	5,670
53	Fire rated door including frame & hardware	1	EA	2,500	2,500
54	Exterior wall finish				
55	Ceramic Tiling to match existing	410	SF	40	16,400
56	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
57	Concrete cove to match existing	41	LF	20	820
58	Interior Wall Finish - Paint	680	SF	5	3,400
59	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
60	Allow for 4" thick concrete pads for equipment	47	SF	20	945
61	Allowance for Mechanical Scope	1	LS	40,000	40,000
62	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
63	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
64	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
65					
66	**Automatic Platform Gates [APGs] - 4'-6" High**				
67	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
68	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
69	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
70	Platform End Gates (PEGs)	4	EA	13,000	52,000
71	Fixed Panels including framing and support; 4'-6" High	3,047	SF	750	2,285,427
72	Spare Parts - Approx. 10% of Material Cost	1	LS	263,786	263,786

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : HOWARD BEACH AIRTRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
73	Testing and commissioning	800	HRS	160	127,944
74	Product Warranty	1	LS	1,000,000	1,000,000
75	Allowance for Braille Signage	80	EA	2,500	200,000
76					
77	**Electrical**				
78	Electrical Upgrades				
79	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
80	Power and Lighting				
81	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
82	Allow for conduit / cable runs for power and communications under platform edge	1,384	LF	60	83,040
83	PSD Connections	1	LS	75,000	75,000
84	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
85	Power to PSD Room from EDR [Conduit & Cable]	250	LF	60	15,000
86	Reserve power to PSD Room from EDR [Conduit & Cable]	300	LF	60	18,000
87	No allowance for new lighting as if APG's are used		Note		EXCL.
88	Grounding				
89	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
90	MISC				
91	Testing and commissioning	1	EA	30,000	30,000
92	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
93					
94	**Communications**				
95	FA System				
96	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
97	CCTV coverage				
98	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
99	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
100	Berthing Technology Sensors				
101	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
102	Train Door Detection System				
103	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
104	Entrapment concerns				
105	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
106	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
107	Engineering and Testing	1,000	Hrs	160	159,930
108	Centralized monitoring/control				

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : HOWARD BEACH AIRTRAIN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
109	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
110	MISC				
111	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
112	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
113	Site Survey and Inspections	1	LS	100,000	100,000
114	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
115	Furnish Test Equipment allowance	1	LS	500,000	500,000
116	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
117					
118	Training				
119	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
120					
121	Out of hours Work				
122	Allow loss of production to work at night say 50%	1	LS	4,050,115	4,050,115
123					
124	TOTAL PSD WORK:				$ 17,550,500
126					
127	ADD ALTERNATIVE				
128					
129	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
130					
131	ADD				
132	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)				Not Applicable
133	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
134	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
135	Platform End Gates (PEGs)				Not Applicable
136	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
137	Spare Parts - Approx. 10% of Material Cost				Not Applicable
138	Structual framing / bracing				
139	HSS4x4x1/2 hanger				Not Applicable
140	L6x6x1/2 continuous angle				Not Applicable
141	Drilling and bolting - 4 bolts at each connection				Not Applicable
142	Platform Edge Repair				
143	Remove concrete platform edge				Previously done
144	Platform edge repair				Previously done
145	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : HOWARD BEACH AIRTRAIN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
146	Signal Work [Each 300' length is associated with one signal light]				
147	Disconnects				Not Applicable
148	Remove signal cables				Not Applicable
149	Remove conduit; Assuming 1"				Not Applicable
150	Install conduit in new position				Not Applicable
151	Install replacement cable; assumed single cable #12				Not Applicable
152	Re-commission / testing as required				Not Applicable
153	Engineering / Shop Drawings / Etc.				Not Applicable
154	Premium Time				Not Applicable
155					
156	OMIT				
157	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
158	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
159	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
160	Platform End Gates (PEGs)				Not Applicable
161	Fixed Panels including framing and support; 4'-6" High				Not Applicable
162	Spare Parts - Approx. 10% of Material Cost				Not Applicable
163	Platform Edge Reconstruction work				Not Applicable
164	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
165	Conduit running under Platform Edge				Not Applicable
166					
167	Allow loss of production to work at night say 50%	1	LS	-	-
168					
169	PREMIUM ASSOCIATED WITH PSD's				$ -

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BROAD CHANNEL

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	680	LF		
5	LENGTH OF THE PLATFORM EDGE =	680	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,360**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,360	LF	7	9,520
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,800	SF	12	81,600
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	137	CY	2,500	342,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,362	EA	25	34,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,362	EA	25	34,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,360	LF	95	129,200
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,360	LF	15	20,400
26	Remove existing platform tiles	1,360	LF	12	16,320
27	Sawcut existing topping concrete at perimeter of removal area	1,360	LF	5	6,800
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,160	SF	8	65,280
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 12'-10" wide	547	SF	8	4,378
30	New Work				
31	New concrete topping to match existing	1,360	SF	15	20,400

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BROAD CHANNEL

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	547	SF	15	8,208
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,953	SF	750	2,214,846
61	Spare Parts - Approx. 10% of Material Cost	1	LS	259,551	259,551
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BROAD CHANNEL

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,360	LF	60	81,600
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	300	LF	60	18,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	350	LF	60	21,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BROAD CHANNEL

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,989,262	3,989,262
112					
113	TOTAL PSD WORK:				$ 17,286,801
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				Not Applicable
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)				Not Applicable
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
123	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
124	Platform End Gates (PEGs)				Not Applicable
125	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
126	Spare Parts - Approx. 10% of Material Cost				Not Applicable
127	Structural framing / bracing				
128	HSS4x4x1/2 hanger				Not Applicable
129	L6x6x1/2 continuous angle				Not Applicable
130	Drilling and bolting - 4 bolts at each connection				Not Applicable
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BROAD CHANNEL

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
148	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
149	Platform End Gates (PEGs)				Not Applicable
150	Fixed Panels including framing and support; 4'-6" High				Not Applicable
151	Spare Parts - Approx. 10% of Material Cost				Not Applicable
152	Platform Edge Reconstruction work				Not Applicable
153	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
154	Conduit running under Platform Edge				Not Applicable
155					
156	Allow loss of production to work at night say 50%	1	LS	-	-
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				$ -

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 90TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	670	LF		
5	LENGTH OF THE PLATFORM EDGE =	670	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,340**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,340	LF	7	9,380
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,700	SF	12	80,400
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	135	CY	2,500	337,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,342	EA	25	33,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,342	EA	25	33,550
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,340	LF	95	127,300
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,340	LF	15	20,100
26	Remove existing platform tiles	1,340	LF	12	16,080
27	Sawcut existing topping concrete at perimeter of removal area	1,340	LF	5	6,700
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,040	SF	8	64,320
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 11'-0" wide	400	SF	8	3,200
30	New Work				
31	New concrete topping to match existing	1,340	SF	15	20,100

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 90TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	400	SF	15	6,000
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,846	SF	750	2,134,650
61	Spare Parts - Approx. 10% of Material Cost	1	LS	254,739	254,739
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 90TH ST

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,340	LF	60	80,400
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	500	LF	60	30,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	550	LF	60	33,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 90TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,966,242	3,966,242
112					
113	TOTAL PSD WORK:				$ 17,187,048
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)				Not Applicable
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
123	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
124	Platform End Gates (PEGs)				Not Applicable
125	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
126	Spare Parts - Approx. 10% of Material Cost				Not Applicable
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger				Not Applicable
129	L6x6x1/2 continuous angle				Not Applicable
130	Drilling and bolting - 4 bolts at each connection				Not Applicable
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 90TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
148	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
149	Platform End Gates (PEGs)				Not Applicable
150	Fixed Panels including framing and support; 4'-6" High				Not Applicable
151	Spare Parts - Approx. 10% of Material Cost				Not Applicable
152	Platform Edge Reconstruction work				Not Applicable
153	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
154	Conduit running under Platform Edge				Not Applicable
155					
156	Allow loss of production to work at night say 50%	1	LS	-	-
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ -

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 98TH ST

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE =	839	LF		
5	LENGTH OF THE PLATFORM EDGE =	839	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,678**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,678	LF	7	11,746
14	Remove 5' wide section of 3" deep structural slab to platform edge	8,390	SF	12	100,680
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	169	CY	2,500	422,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,680	EA	25	42,000
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,680	EA	25	42,000
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,678	LF	95	159,410
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,678	LF	15	25,170
26	Remove existing platform tiles	1,678	LF	12	20,136
27	Sawcut existing topping concrete at perimeter of removal area	1,678	LF	5	8,390
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	10,068	SF	8	80,544
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 10'-10" wide	387	SF	8	3,098
30	New Work				
31	New concrete topping to match existing	1,678	SF	15	25,170
32	New concrete topping at ADA boarding area to match existing	387	SF	15	5,808

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 98TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	4,366	SF	750	3,274,296
61	Spare Parts - Approx. 10% of Material Cost	1	LS	323,118	323,118
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
71	Allow for conduit / cable runs for power and communications under platform edge	1,678	LF	60	100,680

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 98TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
74	Power to PSD Room from EDR including track crossing if needed	550	LF	60	33,000
75	Reserve power to PSD Room from EDR including track crossing if needed	600	LF	60	36,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
79	MISC				
80	Testing and commissioning	1	LS	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 98TH ST

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	4,391,575	4,391,575
113	TOTAL PSD WORK:				$ 19,030,157

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
123	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
124	Platform End Gates (PEGs)				Not Applicable
125	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
126	Spare Parts - Approx. 10% of Material Cost				Not Applicable
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger				Not Applicable
129	L6x6x1/2 continuous angle				Not Applicable
130	Drilling and bolting - 4 bolts at each connection				Not Applicable
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 98TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
148	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
149	Platform End Gates (PEGs)				Not Applicable
150	Fixed Panels including framing and support; 4'-6" High				Not Applicable
151	Spare Parts - Approx. 10% of Material Cost				Not Applicable
152	Platform Edge Reconstruction work				Not Applicable
153	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
154	Conduit running under Platform Edge				Not Applicable
155					
156	Allow loss of production to work at night say 50%	1	LS	-	-
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				-

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 105TH ST

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	633	LF		
5	LENGTH OF THE PLATFORM EDGE =	633	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,266**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,266	LF	7	8,862
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,330	SF	12	75,960
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	127	CY	2,500	317,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,268	EA	25	31,700
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,268	EA	25	31,700
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,266	LF	95	120,270
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,266	LF	15	18,990
26	Remove existing platform tiles	1,266	LF	12	15,192
27	Sawcut existing topping concrete at perimeter of removal area	1,266	LF	5	6,330
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,596	SF	8	60,768
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 10'-10" wide	387	SF	8	3,098
30	New Work				
31	New concrete topping to match existing	1,266	SF	15	18,990

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 105TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	387	SF	15	5,808
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,512	SF	750	1,883,796
61	Spare Parts - Approx. 10% of Material Cost	1	LS	239,688	239,688
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 105TH ST

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,266	LF	60	75,960
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	450	LF	60	27,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	500	LF	60	30,000
76	Allowance for power to cross tracks to opposite platform [Upper level]	1	LS	15,000	15,000
77	Allowance for power to cross tracks to opposite platform [Lower level]	1	LS	15,000	15,000
78	No allowance for new lighting as if APG's are used		Note		EXCL.
79	Grounding				
80	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
81	MISC				
82	Testing and commissioning	1	EA	30,000	30,000
83	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
84					
85	**Communications**				
86	FA System				
87	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
88	CCTV coverage				
89	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
90	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
91	Berthing Technology Sensors				
92	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
93	Train Door Detection System				
94	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
95	Entrapment concerns				
96	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
97	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
98	Engineering and Testing	1,000	Hrs	160	159,930
99	Centralized monitoring/control				
100	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 105TH ST

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
101	MISC				
102	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
103	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
104	Site Survey and Inspections	1	LS	100,000	100,000
105	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
106	Furnish Test Equipment allowance	1	LS	500,000	500,000
107	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
108					
109	Training				
110	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
111					
112	Out of hours Work				
113	Allow loss of production to work at night say 50%	1	LS	3,879,434	3,879,434
115	TOTAL PSD WORK:				$ 16,810,883

117					
118	ADD ALTERNATIVE				
119					
120	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
121					
122	ADD				
123	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
124	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
125	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
126	Platform End Gates (PEGs)				Not Applicable
127	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
128	Spare Parts - Approx. 10% of Material Cost				Not Applicable
129	Structual framing / bracing				Not Applicable
130	HSS4x4x1/2 hanger				Not Applicable
131	L6x6x1/2 continuous angle				Not Applicable
132	Drilling and bolting - 4 bolts at each connection				Not Applicable
133	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long				Not Applicable
134	Platform Edge Repair				
135	Remove concrete platform edge				Previously done
136	Platform edge repair				Previously done
137	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
138	Signal Work [Each 300' length is associated with one signal light]				
139	Disconnects				Not Applicable
140	Remove signal cables				Not Applicable
141	Remove conduit; Assuming 1"				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 105TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Install conduit in new position				Not Applicable
143	Install replacement cable; assumed single cable #12				Not Applicable
144	Re-commission / testing as required				Not Applicable
145	Engineering / Shop Drawings / Etc.				Not Applicable
146	Premium Time				Not Applicable
147					
148	OMIT				
149	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
150	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
151	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
152	Platform End Gates (PEGs)				Not Applicable
153	Fixed Panels including framing and support; 4'-6" High				Not Applicable
154	Spare Parts - Approx. 10% of Material Cost				Not Applicable
155	Platform Edge Reconstruction work				Not Applicable
156	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
157	Conduit running under Platform Edge				Not Applicable
158					
159	Allow loss of production to work at night say 50%	1	LS	-	-
160					
161					
162	**PREMIUM ASSOCIATED WITH PSD's**				-

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : ROCKAWAY PARK BEACH 116TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	731	LF		
5	LENGTH OF THE PLATFORM EDGE =	731	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,462**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,462	LF	7	10,234
14	Remove 5' wide section of 3" deep structural slab to platform edge	7,310	SF	12	87,720
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	147	CY	2,500	367,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,464	EA	25	36,600
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,464	EA	25	36,600
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,462	LF	95	138,890
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,462	LF	15	21,930
26	Remove existing platform tiles	1,462	LF	12	17,544
27	Sawcut existing topping concrete at perimeter of removal area	1,462	LF	5	7,310
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,772	SF	8	70,176
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 27'-8" wide strip	627	SF	8	5,014
30	New Work				
31	New concrete topping to match existing	1,462	SF	15	21,930

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : ROCKAWAY PARK BEACH 116TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	627	SF	15	9,402
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	3,421	SF	750	2,565,962
61	Spare Parts - Approx. 10% of Material Cost	1	LS	280,618	280,618
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : ROCKAWAY PARK BEACH 116TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,462	LF	60	87,720
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	800	LF	60	48,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	850	LF	60	51,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : ROCKAWAY PARK BEACH 116TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	4,138,196	4,138,196
112					
113	TOTAL PSD WORK:				$ 17,932,183
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)				Not Applicable
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
123	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
124	Platform End Gates (PEGs)				Not Applicable
125	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
126	Spare Parts - Approx. 10% of Material Cost				Not Applicable
127	Structural framing / bracing				
128	HSS4x4x1/2 hanger				Not Applicable
129	L6x6x1/2 continuous angle				Not Applicable
130	Drilling and bolting - 4 bolts at each connection				Not Applicable
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : ROCKAWAY PARK BEACH 116TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
148	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
149	Platform End Gates (PEGs)				Not Applicable
150	Fixed Panels including framing and support; 4'-6" High				Not Applicable
151	Spare Parts - Approx. 10% of Material Cost				Not Applicable
152	Platform Edge Reconstruction work				Not Applicable
153	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
154	Conduit running under Platform Edge				Not Applicable
155					
156	Allow loss of production to work at night say 50%	1	LS	-	-
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ -

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 67TH ST GASTON AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	658	LF		
5	LENGTH OF THE PLATFORM EDGE =	658	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,316**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,316	LF	7	9,212
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,580	SF	12	78,960
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,318	EA	25	32,950
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,318	EA	25	32,950
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,316	LF	95	125,020
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,316	LF	15	19,740
26	Remove existing platform tiles	1,316	LF	12	15,792
27	Sawcut existing topping concrete at perimeter of removal area	1,316	LF	5	6,580
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,896	SF	8	63,168
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 10'-10" wide	387	SF	8	3,098
30	New Work				
31	New concrete topping to match existing	1,316	SF	15	19,740

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 67TH ST GASTON AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	387	SF	15	5,808
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,737	SF	750	2,052,546
61	Spare Parts - Approx. 10% of Material Cost	1	LS	249,813	249,813
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 67TH ST GASTON AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,316	LF	60	78,960
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 67TH ST GASTON AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,921,502	3,921,502
112					
113	TOTAL PSD WORK:				$ 16,993,175
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)				Not Applicable
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
123	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
124	Platform End Gates (PEGs)				Not Applicable
125	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
126	Spare Parts - Approx. 10% of Material Cost				Not Applicable
127	Structural framing / bracing				
128	HSS4x4x1/2 hanger				Not Applicable
129	L6x6x1/2 continuous angle				Not Applicable
130	Drilling and bolting - 4 bolts at each connection				Not Applicable
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Allow for remove and reinstall conductor boxes				Not Applicable
142	Re-commission / testing as required				Not Applicable
143	Engineering / Shop Drawings / Etc.				Not Applicable
144	Premium Time				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 67TH ST GASTON AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
149	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
150	Platform End Gates (PEGs)				Not Applicable
151	Fixed Panels including framing and support; 4'-6" High				Not Applicable
152	Spare Parts - Approx. 10% of Material Cost				Not Applicable
153	Platform Edge Reconstruction work				Not Applicable
154	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
155	Conduit running under Platform Edge				Not Applicable
156					
157	Allow loss of production to work at night say 50%	1	LS	-	-
158					
159	**PREMIUM ASSOCIATED WITH PSD's**				$ -

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 60TH ST STATION AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	690	LF		
5	LENGTH OF THE PLATFORM EDGE =	690	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,380**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,380	LF	7	9,660
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,900	SF	12	82,800
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	139	CY	2,500	347,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,382	EA	25	34,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,382	EA	25	34,550
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,380	LF	95	131,100
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,380	LF	15	20,700
26	Remove existing platform tiles	1,380	LF	12	16,560
27	Sawcut existing topping concrete at perimeter of removal area	1,380	LF	5	6,900
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,280	SF	8	66,240
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 10'-8" wide	374	SF	8	2,989
30	New Work				
31	New concrete topping to match existing	1,380	SF	15	20,700

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 60TH ST STATION AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	374	SF	15	5,604
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	3,023	SF	750	2,267,373
61	Spare Parts - Approx. 10% of Material Cost	1	LS	262,702	262,702
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 60TH ST STATION AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,380	LF	60	82,800
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 60TH ST STATION AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	4,001,270	4,001,270
112					
113	TOTAL PSD WORK:				$ 17,338,835
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)				Not Applicable
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
123	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
124	Platform End Gates (PEGs)				Not Applicable
125	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
126	Spare Parts - Approx. 10% of Material Cost				Not Applicable
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger				Not Applicable
129	L6x6x1/2 continuous angle				Not Applicable
130	Drilling and bolting - 4 bolts at each connection				Not Applicable
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 60TH ST STATION AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
148	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
149	Platform End Gates (PEGs)				Not Applicable
150	Fixed Panels including framing and support; 4'-6" High				Not Applicable
151	Spare Parts - Approx. 10% of Material Cost				Not Applicable
152	Platform Edge Reconstruction work				Not Applicable
153	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
154	Conduit running under Platform Edge				Not Applicable
155					
156	Allow loss of production to work at night say 50%	1	LS	-	-
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ -

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 44TH ST FRANK AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	680	LF		
5	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	680	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,360**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,360	LF	7	9,520
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,800	SF	12	81,600
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	137	CY	2,500	342,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,362	EA	25	34,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,362	EA	25	34,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,360	LF	95	129,200
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,360	LF	15	20,400
26	Remove existing platform tiles	1,360	LF	12	16,320
27	Sawcut existing topping concrete at perimeter of removal area	1,360	LF	5	6,800
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,160	SF	8	65,280
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 11'-0" wide	400	SF	8	3,200
30	New Work				
31	New concrete topping to match existing	1,360	SF	15	20,400
32	New concrete topping at ADA boarding area to match existing	400	SF	15	6,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 44TH ST FRANK AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,936	SF	750	2,202,150
61	Spare Parts - Approx. 10% of Material Cost	1	LS	258,789	258,789
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
71	Allow for conduit / cable runs for power and communications under platform edge	1,360	LF	60	81,600

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 44TH ST FRANK AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
74	Power to PSD Room from EDR including track crossing if needed	100	LF	60	6,000
75	Reserve power to PSD Room from EDR including track crossing if needed	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
79	MISC				
80	Testing and commissioning	1	LS	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 44TH ST FRANK AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,975,509	3,975,509
113	TOTAL PSD WORK:				$ 17,227,205

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
123	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
124	Platform End Gates (PEGs)				Not Applicable
125	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
126	Spare Parts - Approx. 10% of Material Cost				Not Applicable
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger				Not Applicable
129	L6x6x1/2 continuous angle				Not Applicable
130	Drilling and bolting - 4 bolts at each connection				Not Applicable
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 44TH ST FRANK AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
148	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
149	Platform End Gates (PEGs)				Not Applicable
150	Fixed Panels including framing and support; 4'-6" High				Not Applicable
151	Spare Parts - Approx. 10% of Material Cost				Not Applicable
152	Platform Edge Reconstruction work				Not Applicable
153	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
154	Conduit running under Platform Edge				Not Applicable
155					
156	Allow loss of production to work at night say 50%	1	LS	-	-
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				-

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 36TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE UPPER PLATFORM EDGE [SOUTH BOUND] =	677	LF		
5	LENGTH OF THE LOWER PLATFORM EDGE [NORTH BOUND] =	677	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,354**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,354	LF	7	9,478
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,770	SF	12	81,240
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	136	CY	2,500	340,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,356	EA	25	33,900
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,356	EA	25	33,900
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,354	LF	95	128,630
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,354	LF	15	20,310
26	Remove existing platform tiles	1,354	LF	12	16,248
27	Sawcut existing topping concrete at perimeter of removal area	1,354	LF	5	6,770
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,124	SF	8	64,992
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 10'-10" wide	387	SF	8	3,098
30	New Work				
31	New concrete topping to match existing	1,354	SF	15	20,310

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 36TH ST

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	387	SF	15	5,808
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,908	SF	750	2,180,796
61	Spare Parts - Approx. 10% of Material Cost	1	LS	257,508	257,508
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 36TH ST

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,354	LF	60	81,240
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	Allowance for power to cross tracks to opposite platform [Upper level]	1	LS	15,000	15,000
77	Allowance for power to cross tracks to opposite platform [Lower level]	1	LS	15,000	15,000
78	No allowance for new lighting as if APG's are used		Note		EXCL.
79	Grounding				
80	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
81	MISC				
82	Testing and commissioning	1	EA	30,000	30,000
83	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
84					
85	**Communications**				
86	FA System				
87	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
88	CCTV coverage				
89	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
90	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
91	Berthing Technology Sensors				
92	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
93	Train Door Detection System				
94	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
95	Entrapment concerns				
96	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
97	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
98	Engineering and Testing	1,000	Hrs	160	159,930
99	Centralized monitoring/control				
100	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 36TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
101	MISC				
102	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
103	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
104	Site Survey and Inspections	1	LS	100,000	100,000
105	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
106	Furnish Test Equipment allowance	1	LS	500,000	500,000
107	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
108					
109	Training				
110	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
111					
112	Out of hours Work				
113	Allow loss of production to work at night say 50%	1	LS	3,977,719	3,977,719
115	TOTAL PSD WORK:				$ 17,236,784

117					
118	ADD ALTERNATIVE				
119					
120	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
121					
122	ADD				
123	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
124	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
125	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
126	Platform End Gates (PEGs)				Not Applicable
127	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
128	Spare Parts - Approx. 10% of Material Cost				Not Applicable
129	Structual framing / bracing				
130	HSS4x4x1/2 hanger				Not Applicable
131	L6x6x1/2 continuous angle				Not Applicable
132	Drilling and bolting - 4 bolts at each connection				Not Applicable
133	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long				Not Applicable
134	Platform Edge Repair				
135	Remove concrete platform edge				Previously done
136	Platform edge repair				Previously done
137	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
138	Signal Work [Each 300' length is associated with one signal light]				
139	Disconnects				Not Applicable
140	Remove signal cables				Not Applicable
141	Remove conduit; Assuming 1"				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 36TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Install conduit in new position				Not Applicable
143	Install replacement cable; assumed single cable #12				Not Applicable
144	Re-commission / testing as required				Not Applicable
145	Engineering / Shop Drawings / Etc.				Not Applicable
146	Premium Time				Not Applicable
147					
148	OMIT				
149	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
150	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
151	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
152	Platform End Gates (PEGs)				Not Applicable
153	Fixed Panels including framing and support; 4'-6" High				Not Applicable
154	Spare Parts - Approx. 10% of Material Cost				Not Applicable
155	Platform Edge Reconstruction work				Not Applicable
156	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
157	Conduit running under Platform Edge				Not Applicable
158					
159	Allow loss of production to work at night say 50%	1	LS	-	-
160					
161					
162	**PREMIUM ASSOCIATED WITH PSD's**				-

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 25TH ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	715	LF		
5	LENGTH OF THE PLATFORM EDGE =	715	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,430**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,430	LF	7	10,010
14	Remove 5' wide section of 3" deep structural slab to platform edge	7,150	SF	12	85,800
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	144	CY	2,500	360,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,432	EA	25	35,800
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,432	EA	25	35,800
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,430	LF	95	135,850
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,430	LF	15	21,450
26	Remove existing platform tiles	1,430	LF	12	17,160
27	Sawcut existing topping concrete at perimeter of removal area	1,430	LF	5	7,150
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,580	SF	8	68,640
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 11'-0" wide	400	SF	8	3,200
30	New Work				
31	New concrete topping to match existing	1,430	SF	15	21,450

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 25TH ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	400	SF	15	6,000
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	3,251	SF	750	2,438,400
61	Spare Parts - Approx. 10% of Material Cost	1	LS	272,964	272,964
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 25TH ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,430	LF	60	85,800
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	1,050	LF	60	63,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	1,100	LF	60	66,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 25TH ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	4,099,293	4,099,293
112					
113	TOTAL PSD WORK:				$ 17,763,604
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)				Not Applicable
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
123	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
124	Platform End Gates (PEGs)				Not Applicable
125	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
126	Spare Parts - Approx. 10% of Material Cost				Not Applicable
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger				Not Applicable
129	L6x6x1/2 continuous angle				Not Applicable
130	Drilling and bolting - 4 bolts at each connection				Not Applicable
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300’ length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1”				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : BEACH 25TH ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
148	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
149	Platform End Gates (PEGs)				Not Applicable
150	Fixed Panels including framing and support; 4'-6" High				Not Applicable
151	Spare Parts - Approx. 10% of Material Cost				Not Applicable
152	Platform Edge Reconstruction work				Not Applicable
153	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
154	Conduit running under Platform Edge				Not Applicable
155					
156	Allow loss of production to work at night say 50%	1	LS	-	-
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				$ -

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : FAR ROCKAWAY MOTT AVE.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	670	LF		
5	LENGTH OF THE PLATFORM EDGE =	670	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,340**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,340	LF	7	9,380
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,700	SF	12	80,400
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	135	CY	2,500	337,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,342	EA	25	33,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,342	EA	25	33,550
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,340	LF	95	127,300
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,340	LF	15	20,100
26	Remove existing platform tiles	1,340	LF	12	16,080
27	Sawcut existing topping concrete at perimeter of removal area	1,340	LF	5	6,700
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,040	SF	8	64,320
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 24'-6" wide	500	SF	8	4,000
30	New Work				
31	New concrete topping to match existing	1,340	SF	15	20,100

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : FAR ROCKAWAY MOTT AVE.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	500	SF	15	7,500
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,858	SF	750	2,143,275
61	Spare Parts - Approx. 10% of Material Cost	1	LS	255,257	255,257
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : FAR ROCKAWAY MOTT AVE.

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,340	LF	60	80,400
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	400	LF	60	24,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	450	LF	60	27,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : FAR ROCKAWAY MOTT AVE.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,966,075	3,966,075
112					
113	TOTAL PSD WORK:				$ 17,186,323
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)				Not Applicable
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
123	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
124	Platform End Gates (PEGs)				Not Applicable
125	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
126	Spare Parts - Approx. 10% of Material Cost				Not Applicable
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger				Not Applicable
129	L6x6x1/2 continuous angle				Not Applicable
130	Drilling and bolting - 4 bolts at each connection				Not Applicable
131	Platform Edge Repair				
132	Remove concrete platform edge				Not Applicable
133	Platform edge repair				Not Applicable
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Not Applicable
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Allow for remove and reinstall conductor boxes				Not Applicable
142	Re-commission / testing as required				Not Applicable
143	Engineering / Shop Drawings / Etc.				Not Applicable
144	Premium Time				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for A/C - Line Stations

24-Jun-19

STATION : FAR ROCKAWAY MOTT AVE.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
149	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
150	Platform End Gates (PEGs)				Not Applicable
151	Fixed Panels including framing and support; 4'-6" High				Not Applicable
152	Spare Parts - Approx. 10% of Material Cost				Not Applicable
153	Platform Edge Reconstruction work				Not Applicable
154	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
155	Conduit running under Platform Edge				Not Applicable
156					
157	Allow loss of production to work at night say 50%	1	LS	-	-
158					
159	PREMIUM ASSOCIATED WITH PSD's				$ -

New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR 'E' LINE STATIONS

S 1 2 3

4 5 6 7

A C E L

B D F M

N R Q W

G J Z

CONTRACT #: C-32516 | STV PROJECT #: 3017214

SUBMITTAL DATE: December 19, 2018

STV 100 Years

Table of Contents

0.0 Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 32 newly evaluated stations, 12 have been found to be not suitable for the installation of PSDs.

> *[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to low-height barriers]*

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues; the platform edge barriers are 15" wide. Where an existing object (wall, stair, and railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Where these PSDs hamper the ability of a wheelchair to turn (a 5'-0" circle) and/or limit path of travel to less than 32", it is declared infeasible. This requirement dictates that if a column or any obstruction measuring less than or equal to 24" in the direction of circulation is present, it may not constrain the circulation path to less than 32"
- Insufficient space for the PSD equipment room; the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow; due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements in regard to the placement of these new barriers in an existing station environment.
- Structural considerations; existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit. There are structural anomalies affecting the ability of platform edges to support PSD loads occurring at the three stations on the 63rd Street line as well as at three stations on the 6th Avenue line. These stations required a further structural analysis that can be found in the station specific reports.

- Car door misalignment (part of Tier 1 selection process): Presently (2018) the NYCT system features three car geometries on the A Division and three car geometries on the B Division. With few exceptions, these cars are freely mixed between lines. The spacing of doors on these differing cars is significantly misaligned, making the installation of platform doors infeasible. Looking to the future, NYCT plans to procure new rolling stock with identical or nearly identical door spacing. The current procurement schedule indicates the purchase of these geometrically compatible cars by 2032. Therefore, our assessment of feasibility is based on the year 2032.

  However, the E line service and an overlapping service on the B Division will remain incompatible even after 2032. The E is a ten-car train, whereas the M line is an eight-car train. The newer trains are assembled in two consists, with a driver / conductor cabin at the front and back of each consist. Due to the cabin, the spacing of doors on the first and last car differs from the door spacing of the other cars of the train. Therefore, there will inevitably be a mismatching of doors as these two differing train types berth at a certain station platform. The M train cannot be extended to a ten-car length because all the station stops in Brooklyn feature station platforms of an eight-car length. Therefore, 16 of the 32 stations are infeasible due to this incompatibility. Please see the diagrams in Figure 1 below.

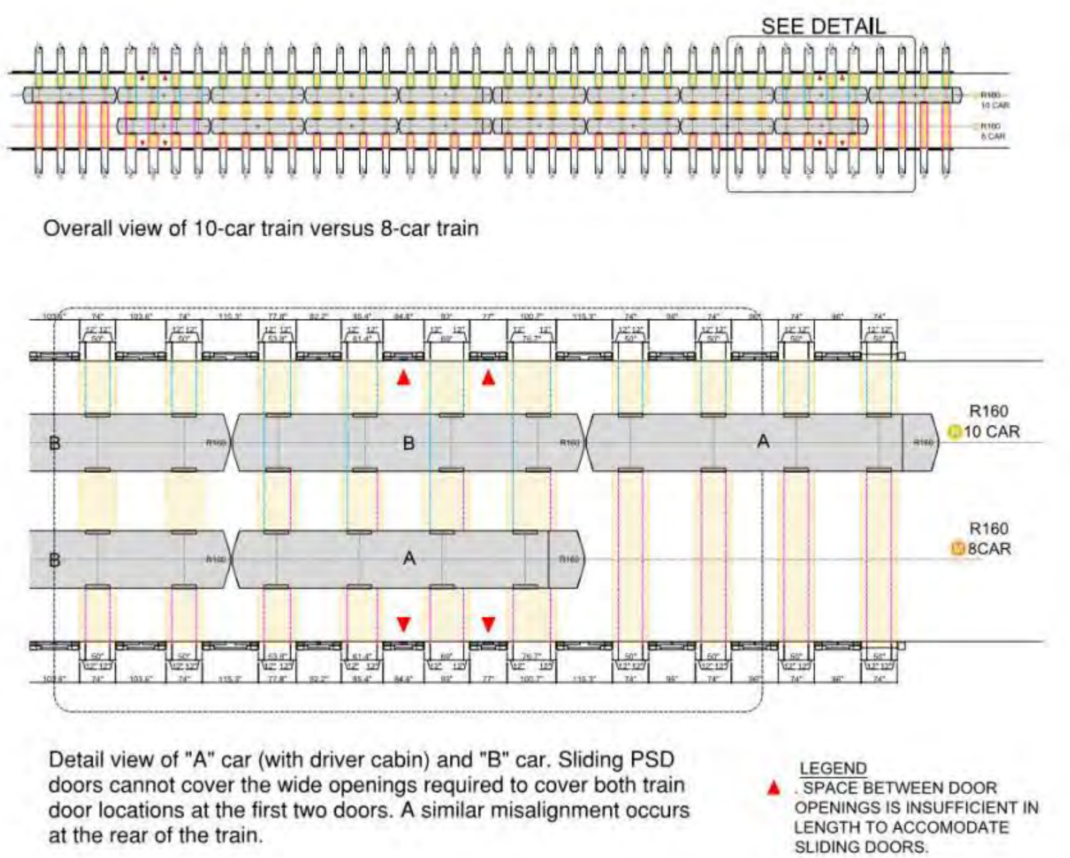

***Figure 1** – Ten-car vs. eight-car train Comparison of door geometry*

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the wall and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is used for removal of garbage at the stations on the 'E' Line. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the off-loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in the damage from these carts which can be observed along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process.

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 37% of the 'E' Line stations. Total implementation cost would be $390.0M for APGs and $504.0M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; That estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of $931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 12 feasible stations, the aggregate annual maintenance cost would be $11.2M.

Summary Table

'E' Line Summary of Feasibility (37% feasible; 12/32)

MR	Station Name	Station Type	Platform Type	Feasible Yes/No	Issues/ Reason for Failure	Cost APGs	Cost PSDs
162	50th Street	SUB	Side	Yes		$33.7M	$43.3M
163	42nd Street Port Authority Bus	SUB	Center/Island	No	ADA clearance		
164	34th Street Penn Station	SUB	Side	Yes		$32.5M	$40.7M
165	23rd Street	SUB	Side	Yes		$32.4M	$41.2M
166	14th Street	SUB	Center/Island	Yes		$32.6M	$43.0M
167	West 4th St.	SUB	Center/Island	Yes		$32.8M	$41.4M
168	Spring Street	SUB	Side	Yes		$32.5M	$42.0M
169	Canal Street	SUB	Center/Island	Yes		$32.4M	$44.2M
171	World Trade Center	SUB	Center/Island	Yes		$32.6M	$45.5M
258	Briarwood	SUB	Side	No	ADA clearance		
259	Kew Gardens	SUB	Center/Island	No	ADA clearance		
260	75 Avenue	SUB	Side	No	ADA clearance		
261	Forest Hills 71st Ave	SUB	Center/Island	No	Tier 1 Failure- train door misalignment		
262	67th Avenue	SUB	Side	No	Tier 1 Failure- train door misalignment		
263	63rd Drive Rego Pk	SUB	Side	No	Tier 1 Failure- train door misalignment		
264	Woodhaven Blvd.	SUB	Side	No	Tier 1 Failure- train door misalignment		
265	Grand Avenue Newtown	SUB	Side	No	Tier 1 Failure- train door misalignment		
266	Elmhurst Avenue	SUB	Side	No	Tier 1 Failure- train door misalignment		
267	Jackson Hts. 74th St. Roosevelt Ave.	SUB	Center/Island	No	Tier 1 Failure- train door misalignment		
268	65 Street	SUB	Side	No	Tier 1 Failure- train door misalignment		
269	Northern Blvd	SUB	Side	No	Tier 1 Failure- train door misalignment		
270	46 Street	SUB	Side	No	Tier 1 Failure- train door misalignment		
271	Steinway Street	SUB	Side	No	Tier 1 Failure- train door misalignment		
272	36 Street	SUB	Side	No	Tier 1 Failure- train door misalignment		
273	Queens Plaza	SUB	Center/Island	No	Tier 1 Failure- train door misalignment		
274	Court Sq. 23rd St. / Ely Ave 44th Dr.	SUB	Side	No	Tier 1 Failure- train door misalignment		
275	Lexington Avenue 53rd St.	SUB	Center/Island	No	Tier 1 Failure- train door misalignment		
276	5th Avenue 53rd St.	SUB	Side	No	Tier 1 Failure- train door misalignment		
277	7th Avenue	SUB	Center/Island	Yes		$32.5M	$42.4M
278	Jamaica Ctr. Parsons / Archer	SUB	Center/Island	Yes		$32.7M	$42.3M
279	Sutphin Blvd Archer Ave	SUB	Center/Island	Yes		$31.7M	$40.6M
280	Jamaica Van Wyck	SUB	Center/Island	Yes		$31.5M	$40.4M
					TOTAL	$390.0M	$504.0M

1.0 Station Assessments

1.01 – MR 162 | 50th Street Station

Summary: *50th Street Station is feasible for both APGs and PSDs. In this two-level station, please note that only the lower platforms were evaluated for this study since the E train stops at that level. There are two ceiling mounted signals located at the queens-bound lower platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG or a PSD system (see structural report; Appendix B). Existing power is adequate. .*

Description

50th Street Station is a below-grade station with two levels of side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. This report only covers the lower level platforms as the upper level platforms service the "C" line which will be examined in an upcoming report. The platform columns are spaced 15'-0" on center, and column faces typically measure 2'-10" from the southbound platform edge and 3'-4" from the northbound platform edge. The southbound platform width varies from 11'-6" to 15'-4" throughout. The northbound platform width varies from 11'-8 to 15'-6". On the northbound platform there are two ceiling mounted signals located above the platform edge, measuring no less than 7'-4" above the ground. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV and standard NYCT wayfinding signage. The signals located above the platform edge would need to be reoriented from a horizontal orientation to a vertical orientation in the implementation of full height PSDs**.**

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

Since there are 4 platform edges at this station, 2 full size equipment rooms would be required. The E-line utilizes only the lower platform; therefore costs generated in this report will only include one equipment room. However, for planning purposes, the location of both equipment rooms have been examined to assure feasibility for the station as a whole. The equipment room for the upper C-line platform could be located at closed control area N053 (not shown; will be detailed in upcoming C-line report) and the equipment room for the lower E-line platform could be located at the far south end of the southbound platform. (**Figure 1 & Figure 2).** The proposed room dimension are 27'-0" x 6'-6" each.

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

Reconstruction of the concrete platform edge will be required for the installation of an APG or PSD system due to the current platform edge condition rating. The 2012 NYCT conditions survey gave the platform edges an average rating of 3.5. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

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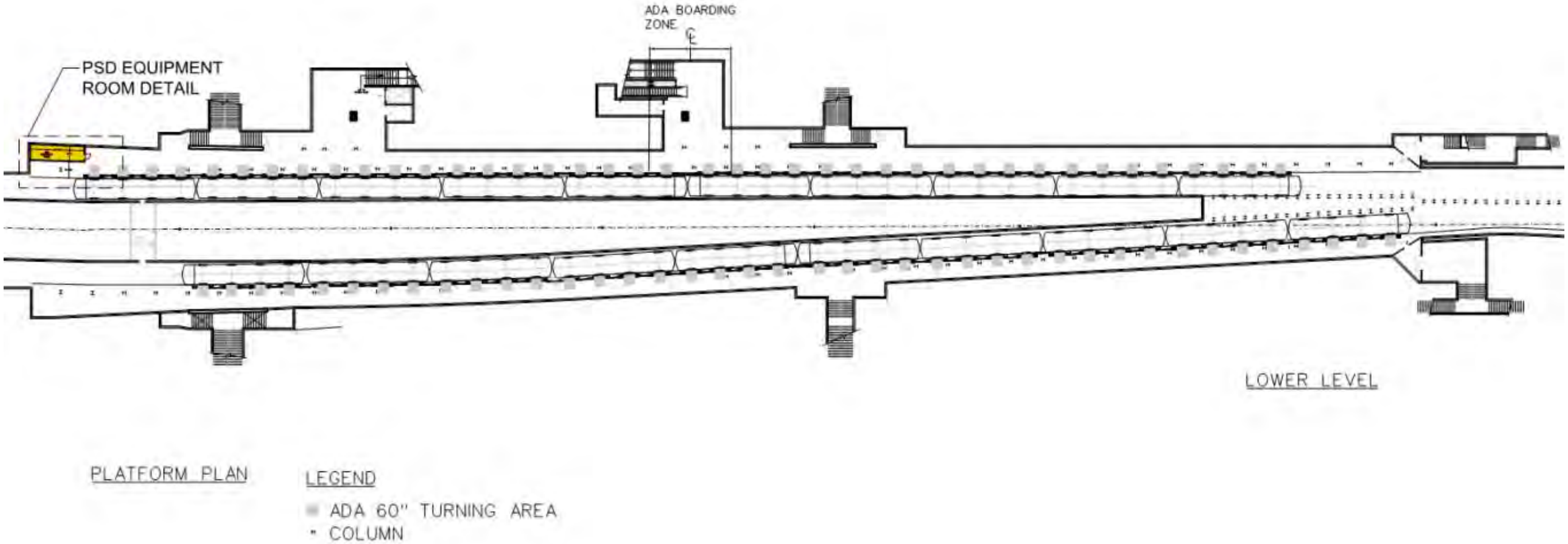

Figure 1 – *Overall Station Plan*
50th Street Station

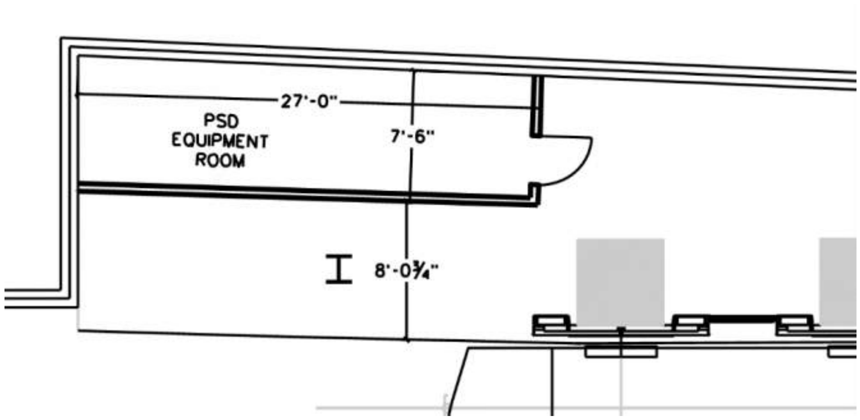

***Figure 2** – PSD Equipment Room 1 at south end of southbound lower platform*
50th Street Station

***Figure 3** – Typical view – lower platform*
50th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:
This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	50th Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	96.0
Apparent Power (kVA)	120.0
Station Peak Demand Load, Max Current, (A)	333.3
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	674
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	526
Is Electrical Service Adequate?	**Yes**
Notes	Analysis is based on 1 line diagram. The station has (2) separate meters with combined meter reading. (Services indicate 1200 A fuses at service switches)

***Table 1**- Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $33.7M to install APGs and $43.2M to install PSDs (See Appendix E)

1.02 – MR 163 | 42nd Street Port Authority Station

Summary: *42nd Street Port Authority Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA complaint wheelchair movement would not be met at the ramp locations on both platform. Wheelchair paths at the ramp locations would be constricted to less than 32".*

Description

42nd Street Port Authority Station is a below-grade station with two straight center/island platforms. The platform structure are cast-in-place concrete. The width of the southbound platform is approximately 35'-0" throughout tapering down to 16'-3" towards the northern end. The width of the northbound platform is approximately 29'-0" throughout tapering down to 24'-0" towards the southern end. There is one ramp along the southbound platform which would constrain wheelchair movement with PSDs installed. Columns are spaced 15' on center with column faces 3'-4" away from all platform edges. The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 25" would not allow for ADA compliant wheelchair movement. **(see Figure 1)**.

Figure 1 – *Non-Compliant ADA condition at ramp*
42nd Street Port Authority

1.03 – MR 164 | 34th Street Penn Station

***Summary:** 34th Street Penn Station is feasible for both APGs and PSDs. There are two ceiling mounted signals located above the each platform edge with a vertical clearance ranging between 7' 4" and 8'0", which would require relocation to implement an APG or PSD system. Platform structural work would be required to support the requirements of an APG system (see structural report; Appendix B). Existing power is inadequate. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.*

Description

34th Street Penn Station is a below-grade station with two straight side platforms and one center/island platform **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 4'-0" from the platform edge. The southbound side platform width varies from approximately 11'-8" to 12'-0" throughout. The northbound side platform width is approximately 11'-6" throughout. The center/island platform width is approximately 25'-6" throughout. On each platform there are two ceiling mounted monitors located above the platform edge, with a vertical clearance of at least 7'-4" **(see Figure 4)**. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Ceiling mounted monitors located above the platform edge would need to be relocated in the implementation of full height PSDs (see figure 3).

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

Since there are 4 platform edges at this station, 2 full size equipment rooms would be required. The equipment rooms could be located at the south of the mezzanine, flush to the wall across from staircase M24A (**see Figure 1, Figure 2, and Figure 3)**. The proposed room dimension are 27'-0" x 6'-6" each.

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edge was reconstructed in the 1990s. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, reconstruction of the concrete platform edge would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 2. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

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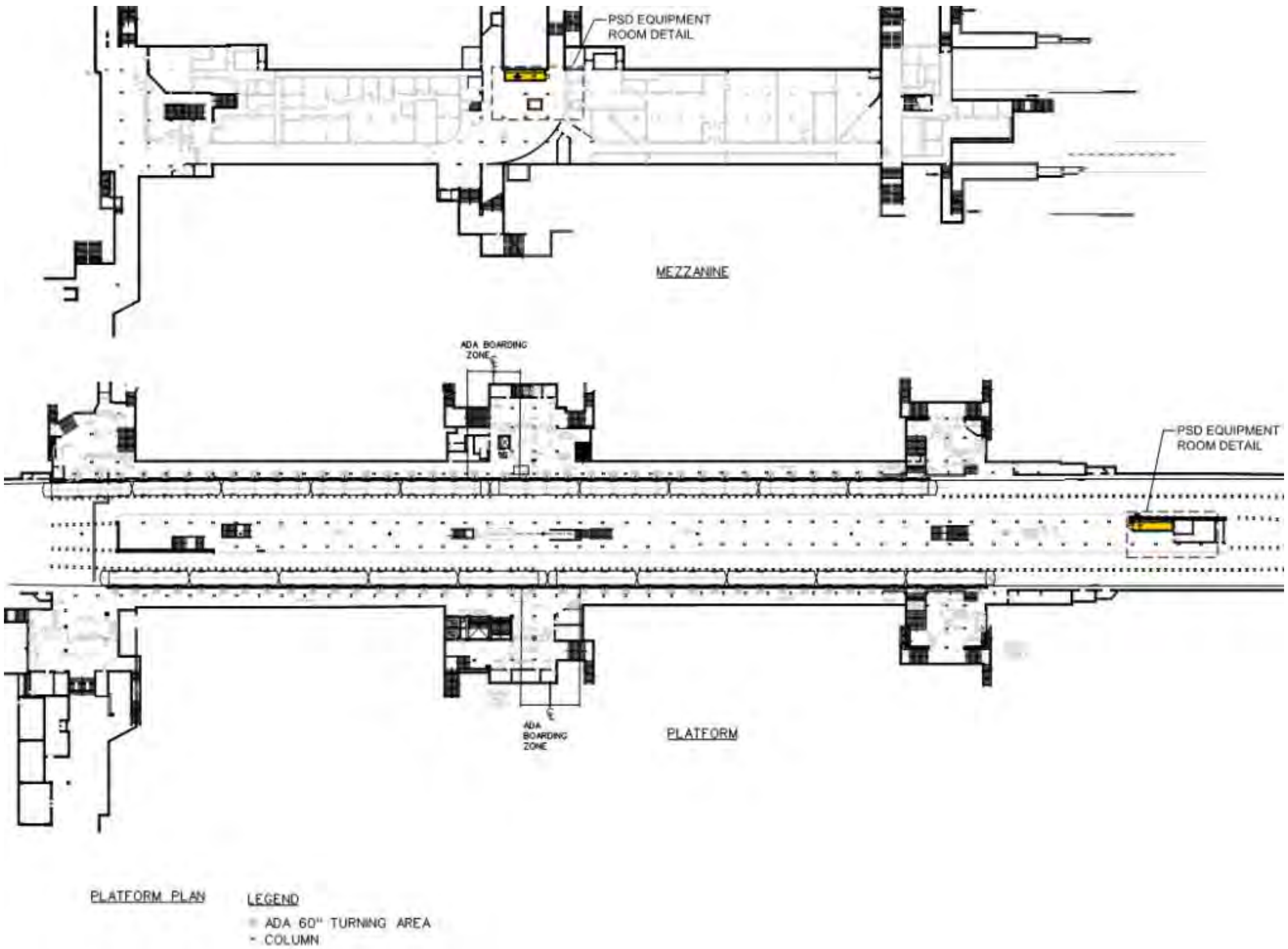

Figure 1 – Overall Station Plan
34th Street Penn Station

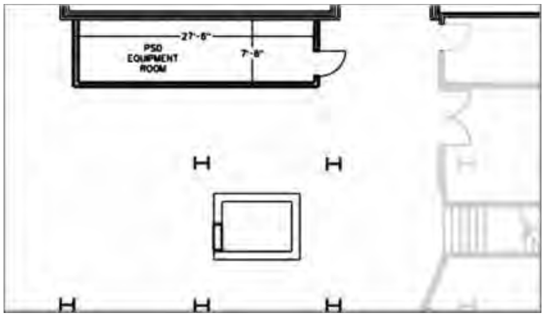

***Figure 2** – PSD Equipment Room 1 Detail*
34th Street Penn Station

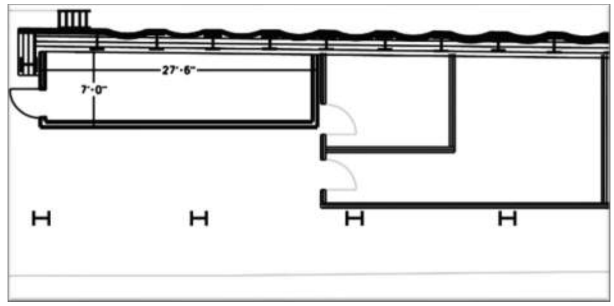

***Figure 3** – PSD Equipment Room 2 Detail*
34th Street Penn Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:
This station has inadequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	34th Street Penn Station
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	293.6
Apparent Power (kVA)	367.0
Station Peak Demand Load, Max Current, (A)	1019.4
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	1360
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	0
Is Electrical Service Adequate?	**No**
Notes	Analysis is based on 1 line diagram. The station has (2) separate meters with combined meter reading. (Services indicate 800 A fuses at service switches)

Table 1- *Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.4M to install APGs and $40.6M to install PSDs (See Appendix E)

***Figure 4** – Typical platform view with signal light*
34th Street Penn Station

1.04 – MR 165 | 23rd Street Station

Summary: *23rd Street Station is feasible for both APGs and PSDs. There is one ceiling mounted signal located at the north end of the southbound platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG or a PSD system (see structural report; Appendix B). Existing power is adequate.*

Description

23rd Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 3'-6" from the platform edge. The southbound side platform width varies from approximately 11'-10" to 17'-8". The northbound side platform width is also approximately 11'-6" to 17'-8". On the north end of the southbound platform there is one ceiling mounted signal located above the platform edge, with a vertical clearance of at least 7'-6" **(see Figure 3)**. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Ceiling mounted monitors located above the platform edge would need to be relocated in the implementation of full height PSDs (see figure 3).

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room could be located at the south end of the southbound platform, flush to the wall (**see Figure 1, Figure 2)**. The proposed room dimension is 27'-0" x 6-6".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

Reconstruction of the concrete platform edge will be required for the installation of an APG or PSD system due to the current platform edge condition rating. The 2012 NYCT conditions survey gave the platform edges an average rating of 2.75. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

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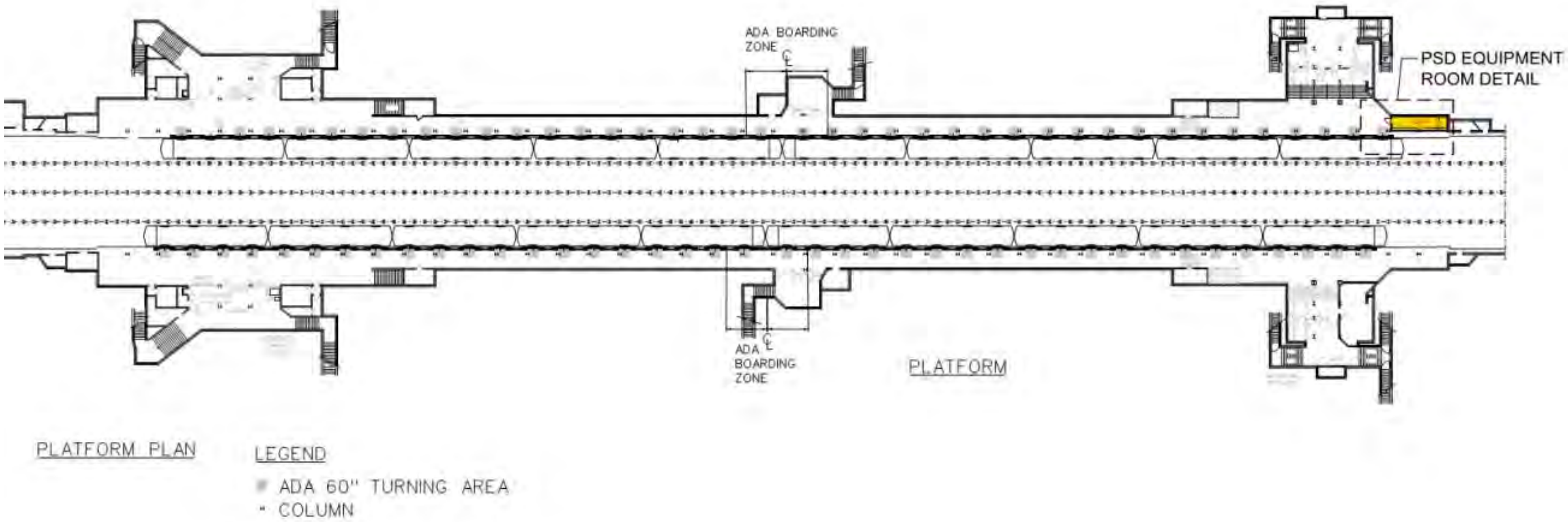

Figure 1 *– Overall Station Plan*
23rd Street Station

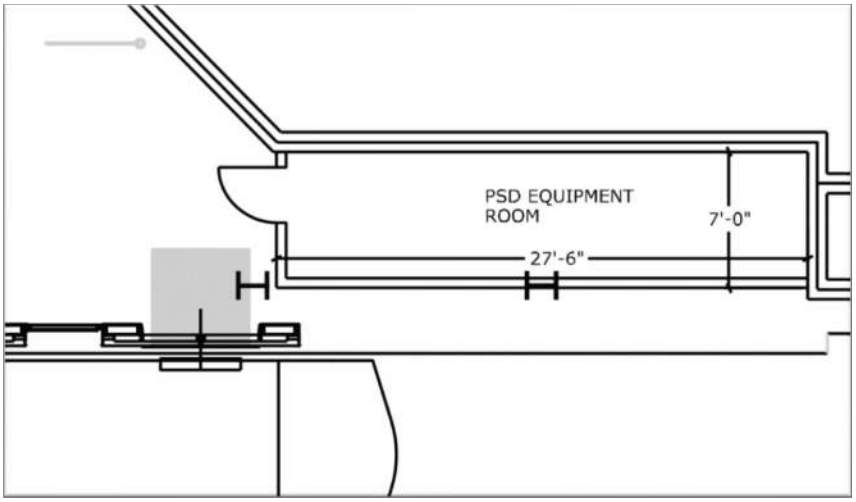

Figure 2 – *PSD Equipment Room 1 Detail*
23rd Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	23rd Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	55.2
Apparent Power (kVA)	69.0
Station Peak Demand Load, Max Current, (A)	191.6
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	388
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	414
Is Electrical Service Adequate?	**Yes**
Notes	Analysis is based on 1 line diagram. The station has (2) separate meters with combined meter reading. (Services indicate 800 A fuses at service switches)

Table 1- *Power Capacity Analysis*

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.4M to install APGs and $42.4M to install PSDs (See Appendix E)

***Figure 3** – Typical platform view with signal light*
23rd Street Station

1.05 – MR 166 | 14th Street Station

Summary: *14th Street Station is feasible for both APGs and PSDs. Note that only the outer platform edges were evaluated for this study; the inner edges will be the subject of an upcoming report for the A-line. There are two ceiling mounted signals located on each platform which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG system (see structural report; Appendix B). Existing power is inadequate. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.*

Description

14th Street Station is a below-grade station with two straight center/island platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 10'-9" from the platform edge. The southbound platform width varies from approximately 21'-4" to 22'-4". The northbound platform width also varies from approximately 21'-4" to 22'-4". On both platforms there are two ceiling mounted signals located above the platform edge, with a vertical clearance of at least 7'-4". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, standard NYCT wayfinding signage, and ceiling mounted monitors. A signal light will need to be re-positioned to facilitate installation of a full-height system.

***Half Height PSDs (aka APGs)*: This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

Since there are 4 platform edges at this station, 2 full size equipment rooms would be required. Since the E train only impacts two of the four platform edges, the cost estimate only includes one equipment room. The equipment rooms could be located at the south of the mezzanine, adjacent to staircase P18 (**see Figure 1, Figure 2 & Figure 3**). The proposed room dimensions are 27'-0" x 6'-6" each.

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edge was reconstructed in the 1990's. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, reconstruction of the concrete platform edge work would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 1.75. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

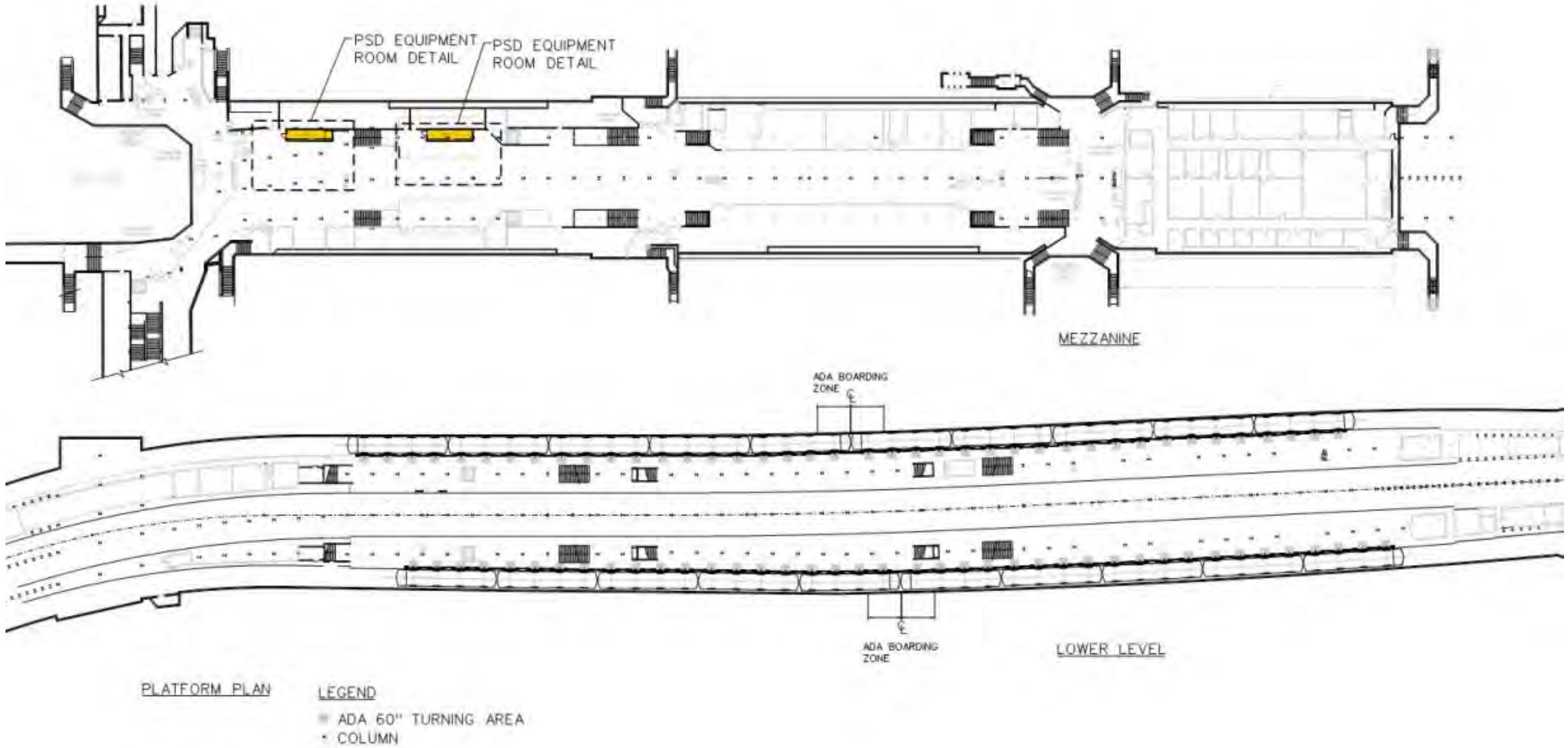

***Figure 1** – Overall Station Plan*
14th Street Station

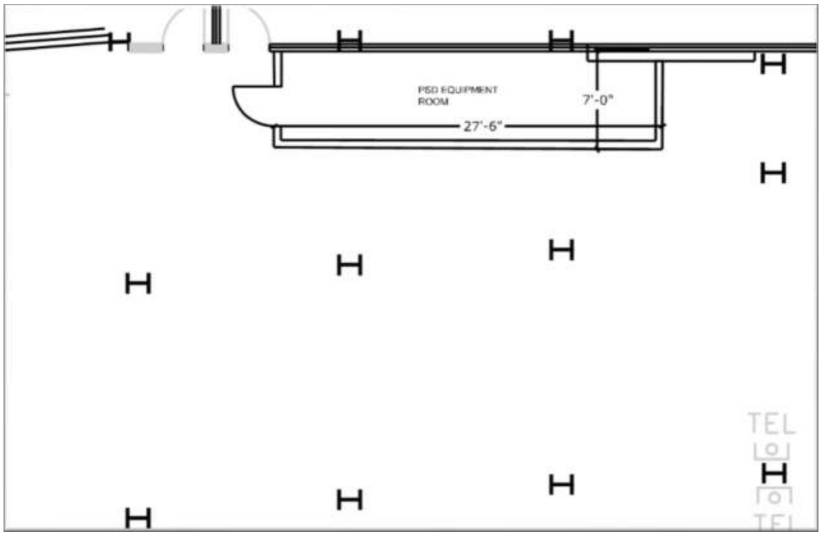

Figure 2 *– PSD Equipment Room 1 Detail*
14th Street Station

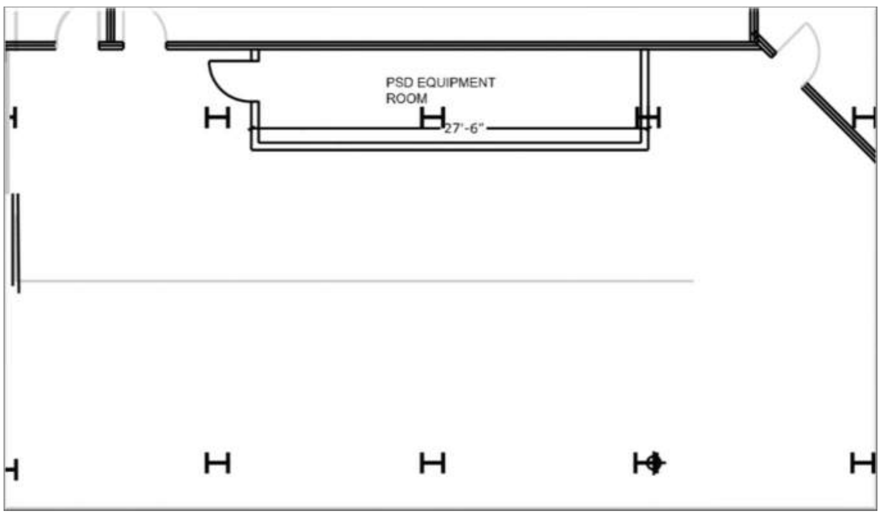

Figure 3 *– PSD Equipment Room 2 Detail*
14th Street Station

Platform obstructions within 5’ of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:
This station has inadequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	14th Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	339.2
Apparent Power (kVA)	424.0
Station Peak Demand Load, Max Current, (A)	1177.8
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	1518
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	0
Is Electrical Service Adequate?	**NO**
Notes	Analysis is based on 1 line diagram. The station has (2) separate meters with combined meter reading. (Service was upgraded from 800 A to 1200A)

Table 1: *Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.6M to install APGs and $43.0M to install PSDs (See Appendix E)

Figure 4 *– Typical platform view with signal light*
14th Street Station

1.06 – MR 167 | West 4th Street Station

Summary: *West 4th Street Station is feasible for both APGs and PSDs. Note that only the upper 8th Avenue platforms were evaluated for this report; the lower 6th Avenue platforms will be evaluated in an upcoming report. There are two ceiling mounted signals located at the northbound platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG or a PSD system (see structural report; Appendix B).* Existing power is inadequate. *We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.*

Description

West 4th Street Station is a below-grade station with two levels of center/island platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. This report only covers the upper level platform as the upper level platform services the "E" line. The lower level will be reported on in a subsequent report. The platform columns are spaced 15'-0" on center, and column faces typically measure 3'-4" from platform edge. The northbound platform width measures approximately 25'-6" throughout. The southbound platform width measures approximately 27-2" throughout. On the southbound platform there are two ceiling mounted signals located above the platform edge, measuring no less than 7'-4" above the ground the **(see Figure 4)**. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. The signals located above the platform edge would need to be reoriented from a horizontal orientation to a vertical orientation in the implementation of full height PSDs **(see figure 4).**

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

Since there are 4 platform edges at the upper level of this station, 2 full size equipment rooms would be required. Since the E train only impacts two of the four platform edges, the cost estimate only includes one equipment room. The equipment rooms could be located in the mezzanine (**see Figure 1, Figure 2 & Figure 3).** The proposed room dimension are 27'-0" x 6'-6" each.

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

Reconstruction of the concrete platform edge will be required for the installation of an APG or PSD system due to the current platform edge condition rating. The 2012 NYCT conditions survey gave the platform edges an average rating of 2.625. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

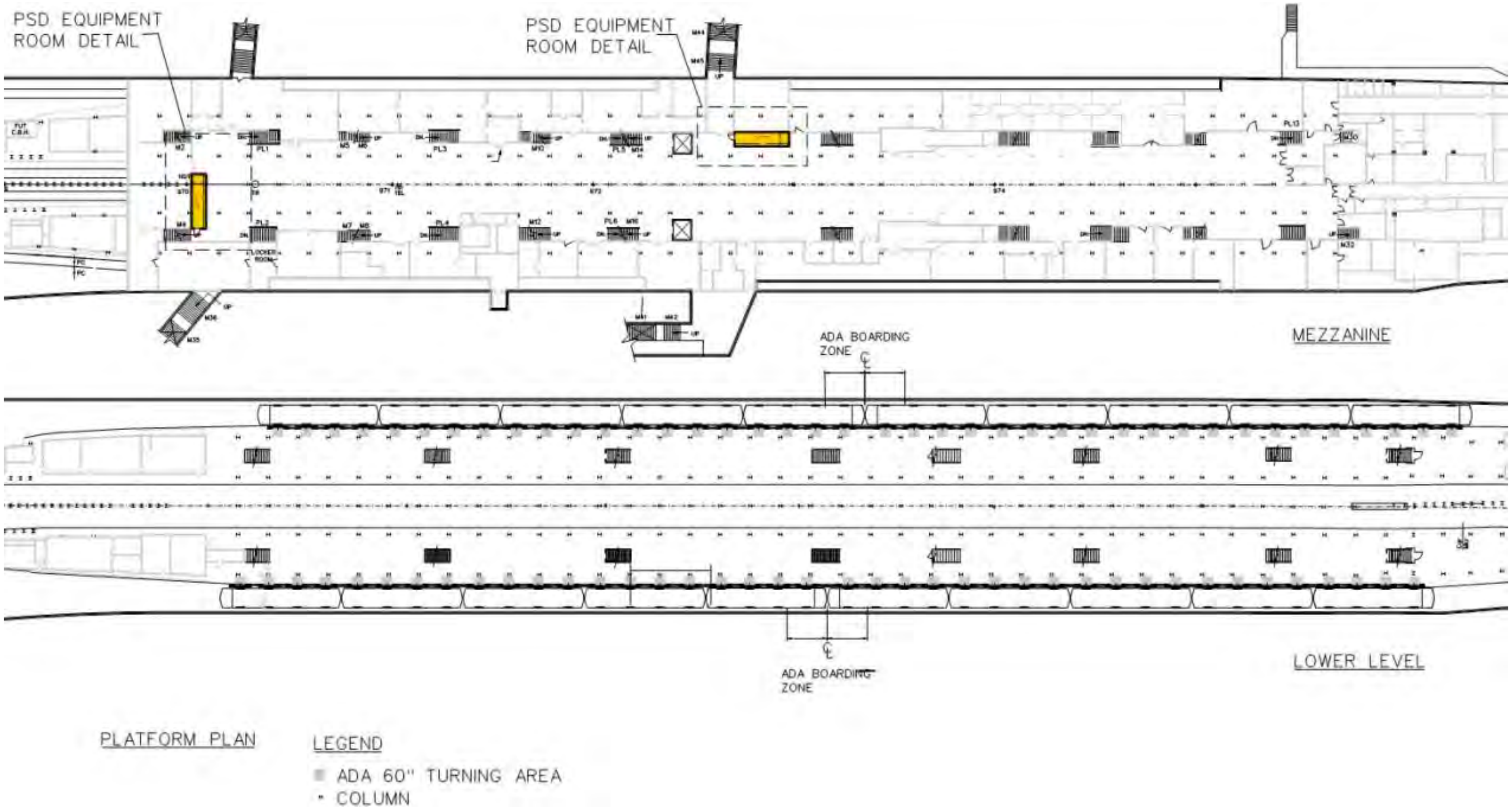

***Figure 1** – Overall Station Plan*
West 4th Street Station

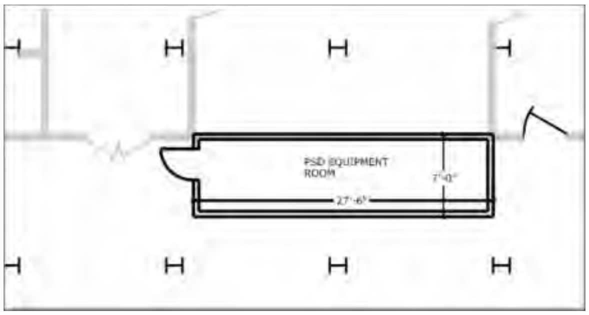

Figure 2 *– West 4th Street Station*
PSD Equipment Room 1 Detail

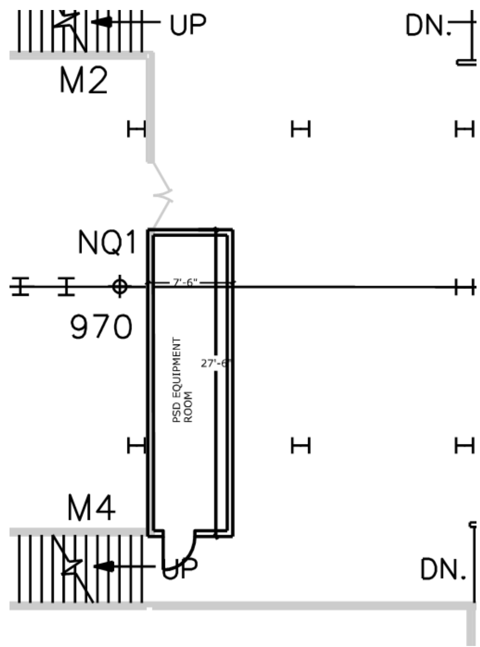

Figure 3 *– West 4th Street Station*
PSD Equipment Room 1 Detail

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:
This station has inadequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	West 4th St.
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	292.0
Apparent Power (kVA)	365.0
Station Peak Demand Load, Max Current, (A)	1013.9
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	1354
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	0
Is Electrical Service Adequate?	**No**
Notes	Analysis is based on 1 line diagram. The station has (2) separate meters with combined meter reading. (Services indicate 1200 A fuses at service switches)

Table 1*- Power Capacity Analysis*

Historic Restrictions:
West 4th Street Station is a historically designated property. As such, design will require review by the New York State Historical Preservation Office.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not

based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.8M to install APGs and $41.4 to install PSDs (See Appendix E)

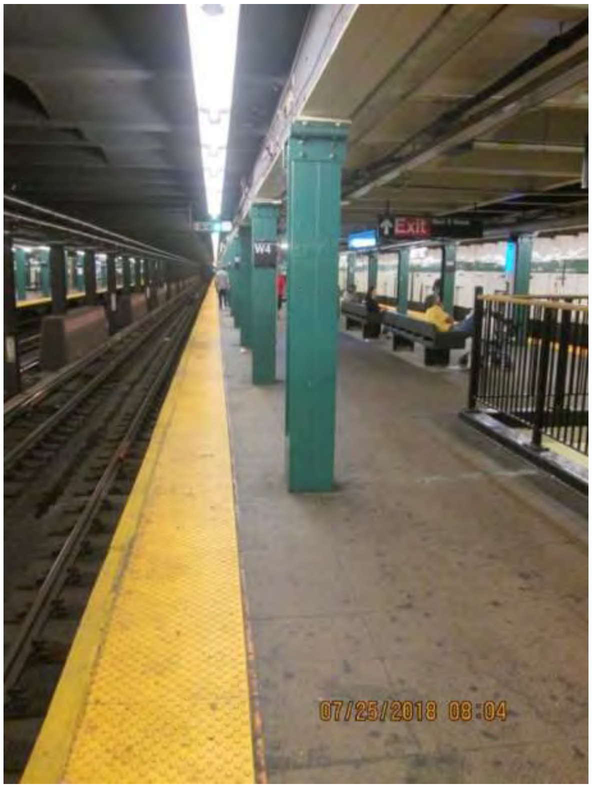

***Figure 4** – Typical platform view with signal light*
West 4th Street Station

1.07 – MR 168 | Spring Street Station

Summary: *Spring Street Station is feasible for both APGs and PSDs. There is one ceiling mounted signal located at each platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG or a PSD system (see structural report; Appendix B). Existing power is adequate.*

Description

Spring Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 3'-6" from the platform edge. The southbound side platform width varies from approximately 11'-8" to 17'-8". The northbound side platform width varies from 11'-8" to 17'-0". On both platforms there is one ceiling mounted signal located above the platform edge, with a vertical clearance of at least 7'-5" **(see Figure 3)**. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Ceiling mounted signals located above the platform edge would need to be relocated in the implementation of full height PSDs **(see Figure 3).**

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room could be located at the north end of the north platform, flush to the wall adjacent to staircase P14 (**see Figure 1, Figure 2)**. The proposed room dimension is 27'-0" x 6-6".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

Reconstruction of the concrete platform edge will be required for the installation of an APG or PSD system due to the current platform edge condition rating. The 2012 NYCT conditions survey gave the platform edges an average rating of 3.25. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

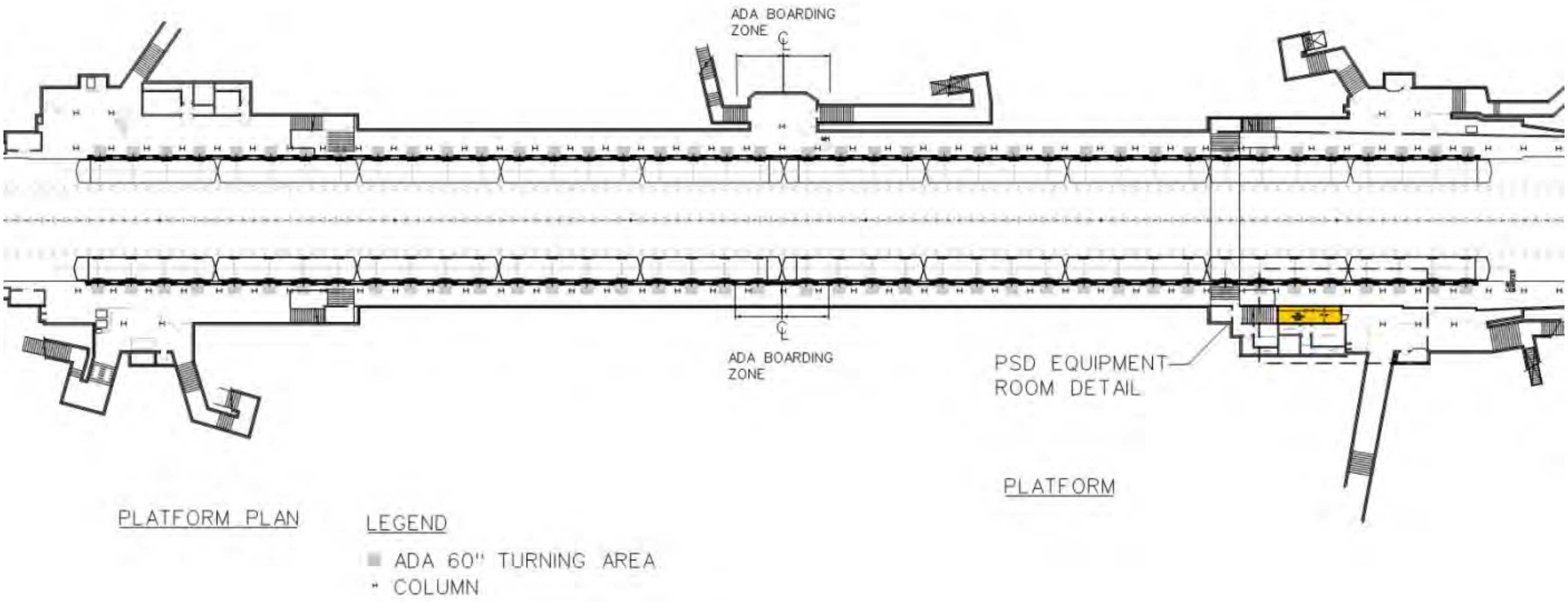

***Figure 1** – Overall Station Plan*
Spring Street Station

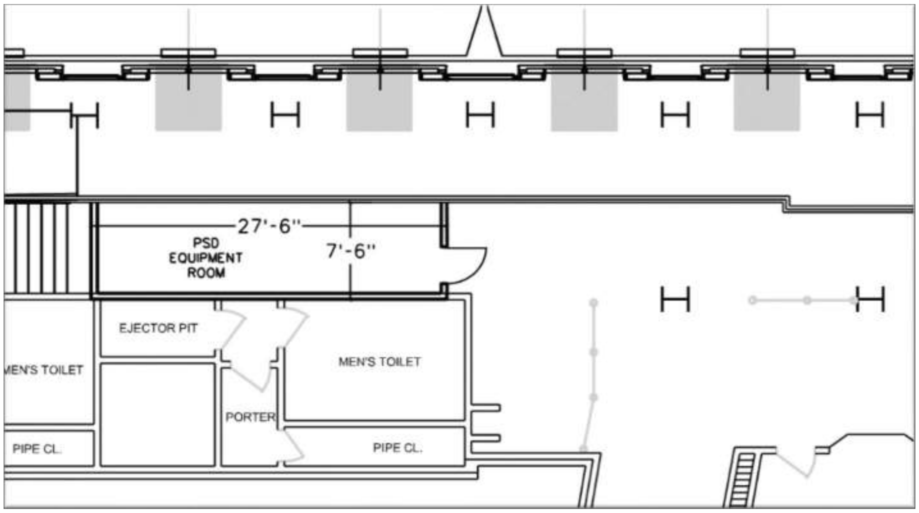

Figure 2 **–** *PSD Equipment Room 1 Detail*
Spring Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:
This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Spring Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	80.4
Apparent Power (kVA)	100.5
Station Peak Demand Load, Max Current, (A)	279.2
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	474
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	726
Is Electrical Service Adequate?	**Yes**
Notes	Analysis is based on 1 line diagram. The station has (2) separate meters with combined meter reading.

***Table 1**- Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.5M to install APGs and $41.2M to install PSDs (See Appendix E)

Figure 3 *– Typical platform view with signal light*
Spring Street Station

1.08 – MR 169 | Canal Street Station

Summary: *Canal Street Station is feasible for both APGs and PSDs. There are three ceiling mounted signals located on each platform which would require relocation to implement a full height PSD system. Platform structural work would be required to support the requirements of an APG or a PSD system (see structural report; Appendix B). Existing power is adequate.*

Description

Canal Street Station is a below-grade station with two straight center/island platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 10'-6" from the platform edge. The southbound platform width varies from approximately 15'-6" to 22'-4". The northbound platform width varies from approximately 19''-6" to 22'-2". On both platforms there are three ceiling mounted signals located above the platform edge, with a vertical clearance of at least 7'-1" **(see Figure 4)**. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Ceiling mounted signals located above the platform edge would need to be relocated in the implementation of full height PSDs **(see Figure 4).**

***Half Height PSDs (aka APGs)*: This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

Since there are 4 platform edges at this station, 2 full size equipment rooms would be required. The equipment rooms could be located at the center of the mezzanine, flush to the adjacent to Transit Police Offices (**see Figure 1, Figure 2 & Figure 3**). The proposed room dimensions are 27'-0" x 6'-6" each.

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed in the 1990s. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, reconstruction of the concrete platform edge will be required only for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 2.25. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

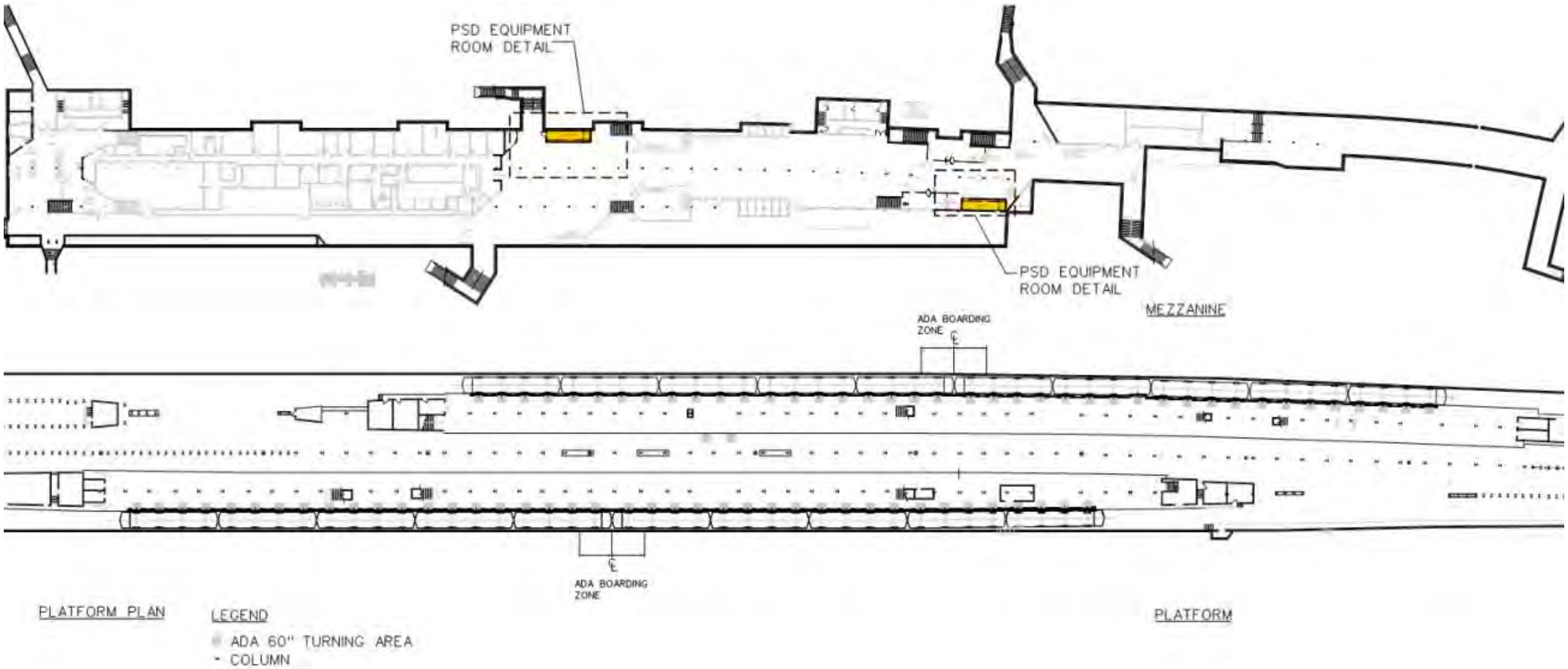

***Figure 1** – Overall Station Plan*
Canal Street Station

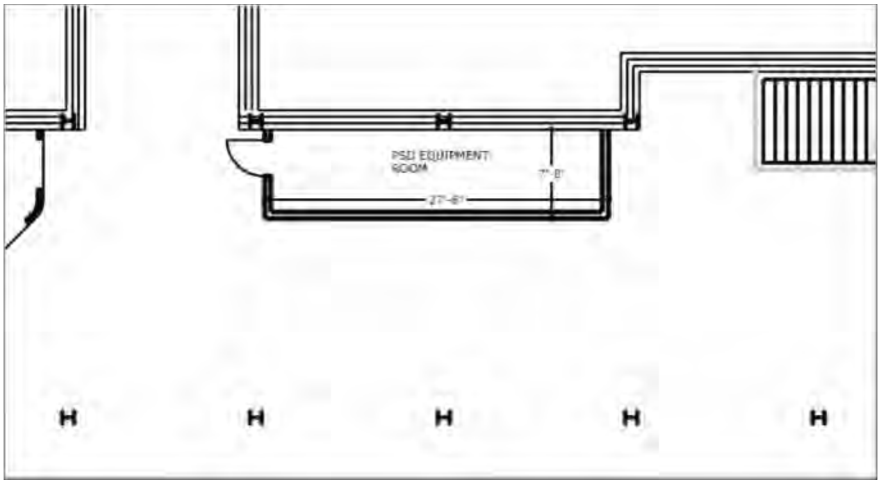

Figure 2 *– PSD Equipment Room 1 Detail*
Canal Street Station

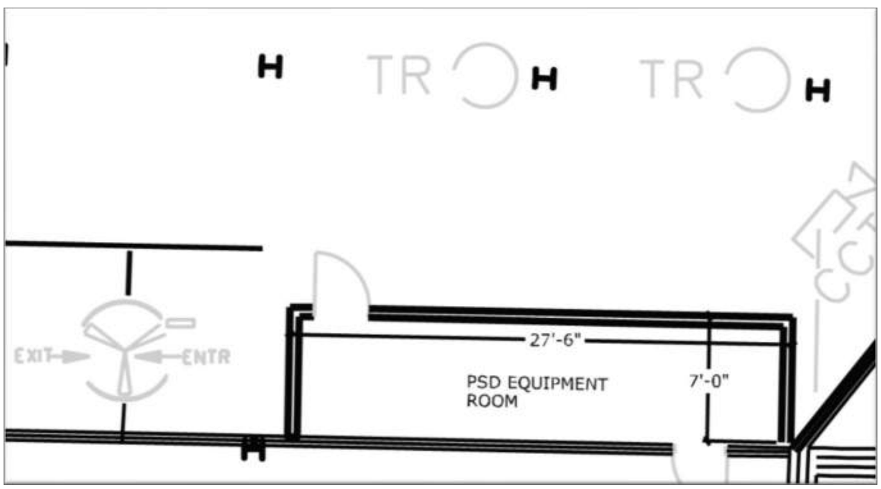

Figure 3 *– PSD Equipment Room 2 Detail*
Canal Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:
This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

**Station
Power Capacity Analysis**

Station Name	Canal Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	90.4
Apparent Power (kVA)	113.0
Station Peak Demand Load, Max Current, (A)	313.9
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.8
Total Load (Station Peak + PSD), (A)	655
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	145
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram. Station has (2) separate meter reading, for each Normal & Reserve service. This analysis is for **Reserve service**

Table 1- *Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.4M to install APGs and $44.2M to install PSDs (See Appendix E)

***Figure 4** – Typical platform view with signal light*
Canal Street Station

1.09 – MR 171 | World Trade Center Station

Summary: *World Trade Center Station is feasible for both APGs and PSDs. There are two ceiling mounted signals located at the platform edges which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG system (see structural report; Appendix B). Existing power is adequate.*

Description

World Trade Center Station is a below-grade station with one center/island platforms **(see Figure 1)**. The platform structure is cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 4'-0" from the platform edge. The platform width ranges from approximately 16'-2" to 34'-6". On the platform there are two ceiling mounted signals located above the platform edge, one measuring at 7'-0" above the ground the second measuring 7'-4" above the ground. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Ceiling mounted signals located above the platform edge would need to be relocated in the implementation of full height PSDs.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room could be located at the northern mezzanine between staircase P11 & P12 (**see Figure 1, Figure 2**). The proposed room dimension is 27'-0" x 6-6".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed in the 1990s. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 1.75. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

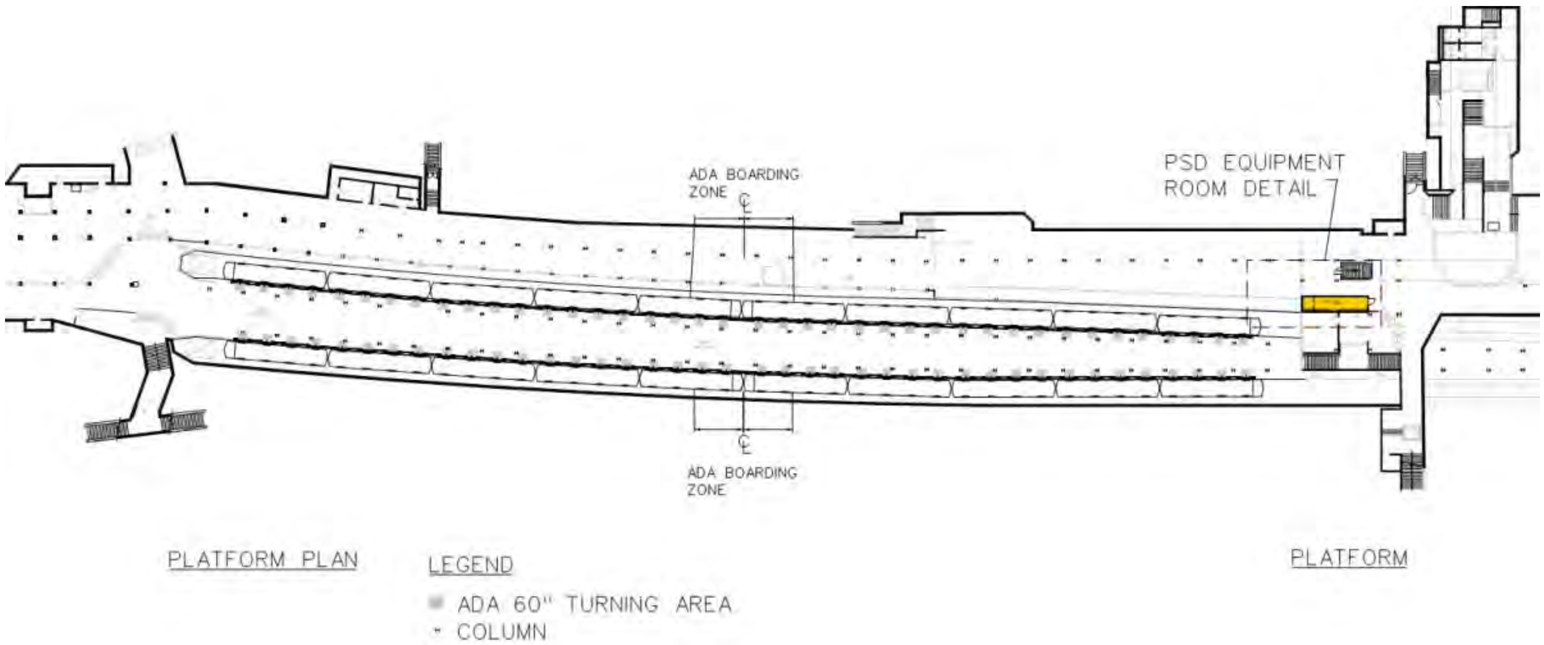

***Figure 1** – Overall Station Plan*
World Trade Center Station

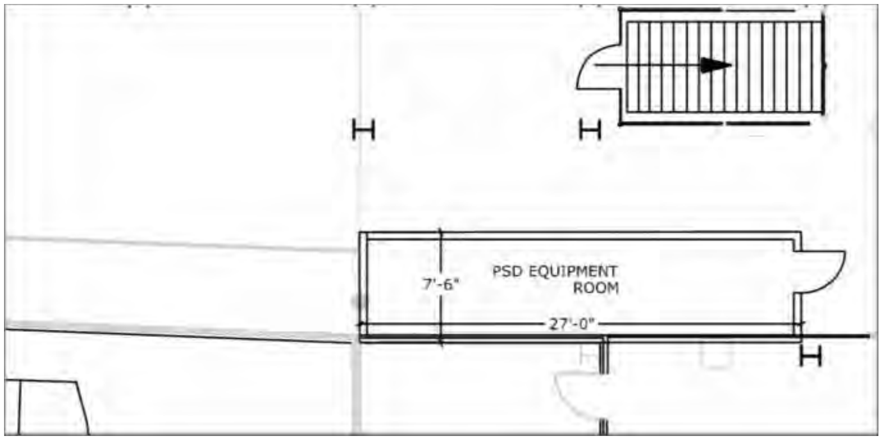

***Figure 2** – PSD Equipment Room 1 Detail*
World Trade Center Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:
This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	World Trade Center
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	89.2
Apparent Power (kVA)	111.5
Station Peak Demand Load, Max Current, (A)	309.7
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	504
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	296
Is Electrical Service Adequate?	**Yes**
Notes	Analysis is based on 1 line diagram(Titled: Chambers St Stn). The station has (2) separate meters with combined meter reading. At present, Normal EDR Con Ed meter is removed from its pan and lying in the room.

***Table 1**- Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.6M to install APGs and $42.5M to install PSDs (See Appendix E)

Figure 3 ***–*** *Typical platform view*
World Trade Center Station

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1.10 MR-258 | Briarwood Station

***Summary:** Briarwood Station (MR-258) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 23" (see figure 1). This condition occurs at all stairs on both platforms.*

Description

Briarwood Station is a below-grade station with two straight side platforms. The platform structure is cast-in-place concrete. The width of both platforms is approximately 11'-4". There are four staircases along each platform, all of which would not allow for the 32" width required for wheelchair movement with PSDs installed. Columns divide the path between the stairs and the platform edge. Column spacing along the length of the platform is approximately 15'-0" on center and column faces are typically 3'-2" to the edge of the platform. Currently, there is an ADA-compliant path of travel between columns and the platform edge (3'-2"). The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 23" would not allow for ADA compliant wheelchair movement nor regular passenger movement.

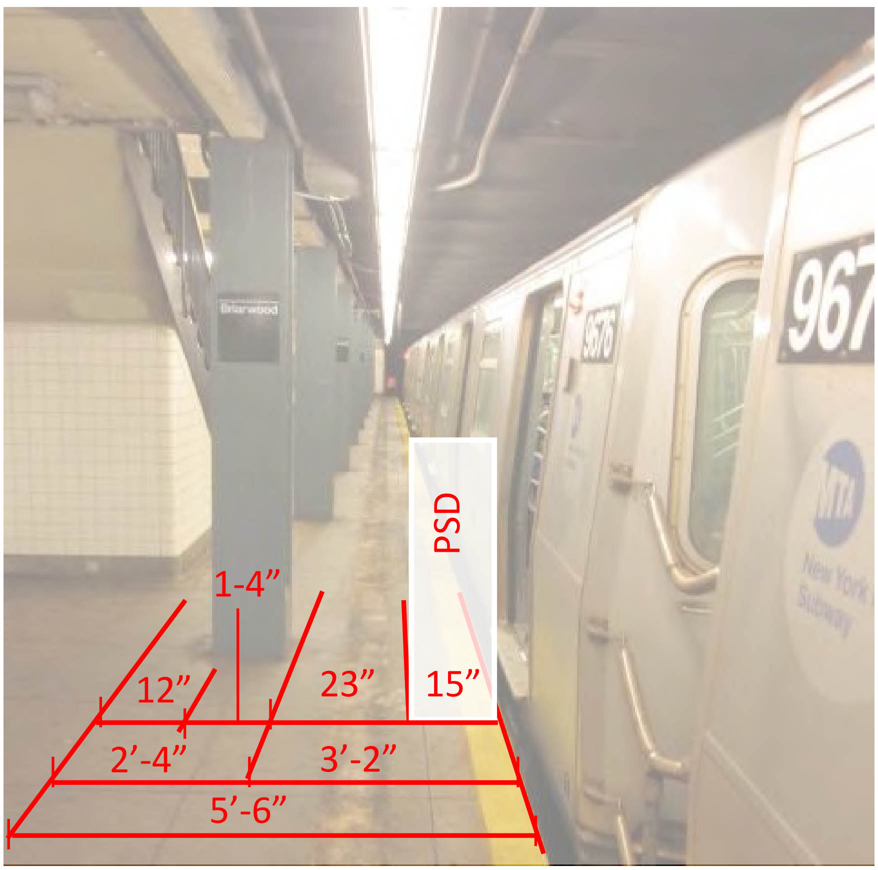


Figure 1 – Non-compliant ADA condition at stairs (typical)- Briarwood Station

1.11 MR-259 | Kew Gardens-Union Turnpike Station

Summary: *Kew Gardens-Union Turnpike Station (MR-259) is not feasible for both APGs and PSDs. The implementation of a platform edge barrier would result in non-compliant ADA conditions that would not allow for wheelchair movement along the length of the platform. At all stairs, the 32" minimum requirement for wheel chair circulation would not be met on one side of the platform (see figure 1). The remaining width would be 24".*

Description

Kew Gardens-Union Turnpike Station is a below-grade station consisting of two mildly curved center/island platforms. The cast-in-place concrete platforms are accessed via two mezzanines. There are six stairs and an elevator located on each platform. The platform is approximately 19'-0" wide. Column spacing along the length of the platform is approximately 15' on center and column faces are typically 3'-3" to the edge of the platform. Currently, at all stairs along the length of the platform a wheel chair can move between the columns and the platform edge (3'-3"). All of the stairs are off center as shown in figure 1. Although there is adequate clear space on one side of the platform, the implementation of a platform edge barrier would not allow for ADA compliant wheelchair movement at the other side. Similarly, the elevators are shifted towards one side of the platform not allowing for 32" clearance (at one platform edge) for ADA compliant wheelchair movement. Both platform edges need to comply in order for the station to be ADA compliant for the implementation of a platform edge barrier.

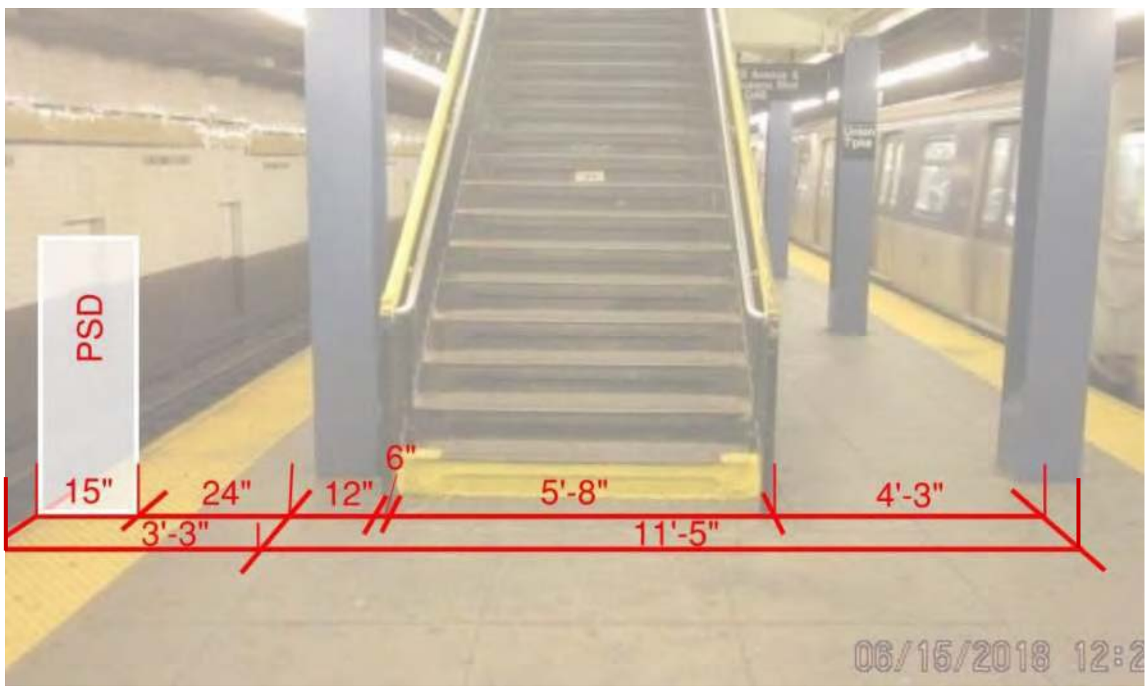


Figure 1 – Non-compliant condition on one side of the center/island platform- Kew Gardens-Union Turnpike

1.12 MR-260 | 75th Avenue Station

***Summary:** 75th Avenue Station (MR-260) is not feasible for both APGs and PSDs. The implementation of a platform edge barrier would result in non-compliant ADA conditions that would not allow for ADA compliant wheelchair movement along the length of the platform. At all stairs, the 32" minimum requirement for wheel chair circulation would not be met (see figure 1).*

Description

75th Avenue Station is a below-grade station consisting of two straight side platforms. The cast-in-place concrete platforms are accessed via a large mezzanine level. There are four stairs located in various locations along the length of each platform. The platforms are approximately 11'-4" wide. Column spacing along the length of the platform is approximately 15' on center and column faces are typically 3'-4" to the edge of the platform. Columns are 1'-10" away from stairs (not an ADA compliant path). Currently, at all stairs along the length of the platform, a wheel chair can move between the columns and the platform edge (3'-4"). In the implementation of a platform edge barrier, this clearance would be reduced to 25" which is not ADA compliant.

Figure 1 – Non-compliant condition at stairs (typical) - 75th Avenue

1.13 – MR 277 | 7th Avenue Station

Summary: *7th Avenue Station is feasible for both APGs and PSDs. There are four ceiling mounted signals located at the lower platform edges which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG or a PSD system (see structural report; Appendix B). Existing power is adequate.*

Description

7th Avenue Station is a below-grade station with two levels of center/island platforms **(see Figure 1)**. The E train utilizes the north side of both the upper and lower platform. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center. At the upper level platform, column faces are typically 5'-4" from the platform edge and the platform measures 29'-4" wide throughout save for a slight taper to 24'-6" at the eastern end of the platform. At the lower level platform column faces typically measure 2'-8" from the Queens-bound platform edge and 3'10" from the Uptown-bound platform edge, the platform width varies slightly from 21'-8" to 24'-8" save for a slight taper to 13'-0" at the western end. On the lower platform there are four ceiling mounted signals located above the platform edge, measuring no less than 7'-4" above the ground the **(see Figure 4)**. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Ceiling mounted signals located above the platform edge would need to be relocated in the implementation of full height PSDs **(see figure 4).**

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

Since there are 4 platform edges at this station, 2 full size equipment rooms would be required. The equipment rooms could be located at the western end of the upper level platform adjacent to staircase P9 and at the center of the lower platform (**see Figure 1, Figure 2 & Figure 3).** The proposed room dimension are 27'-0" x 6'-6" each.

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed in the 1990s. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 3.375. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

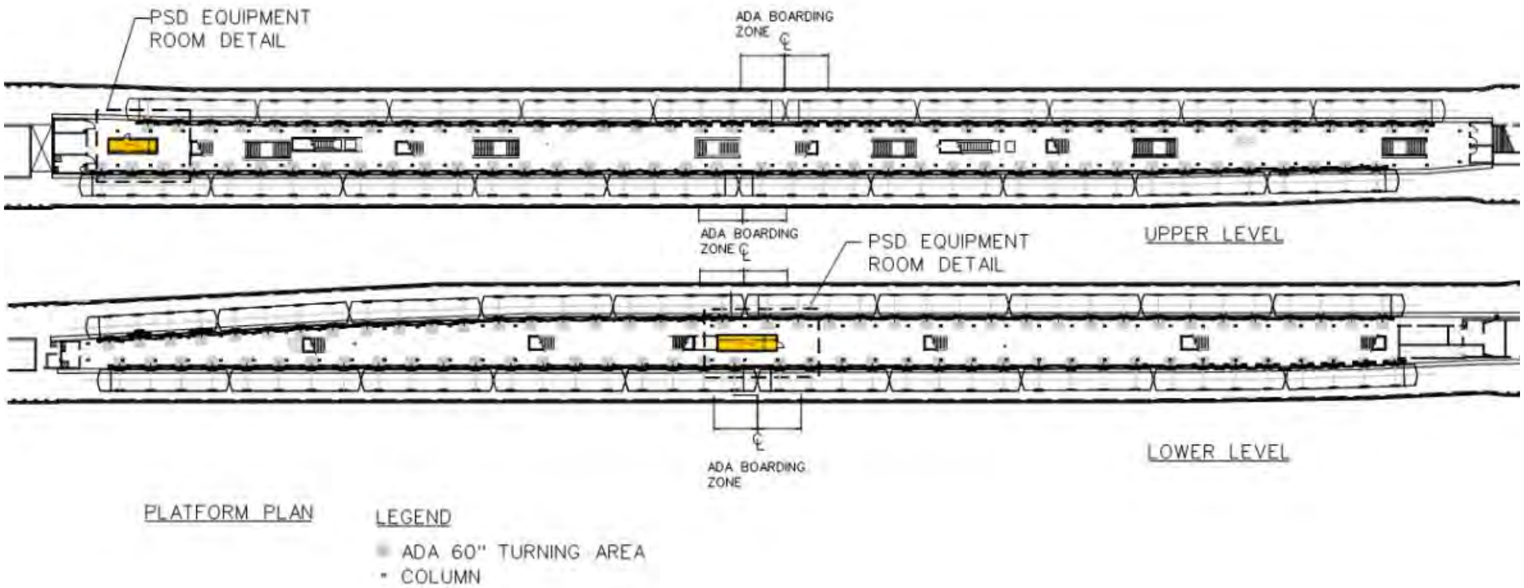


***Figure 1** – Overall Station Plan*
7th Avenue Station

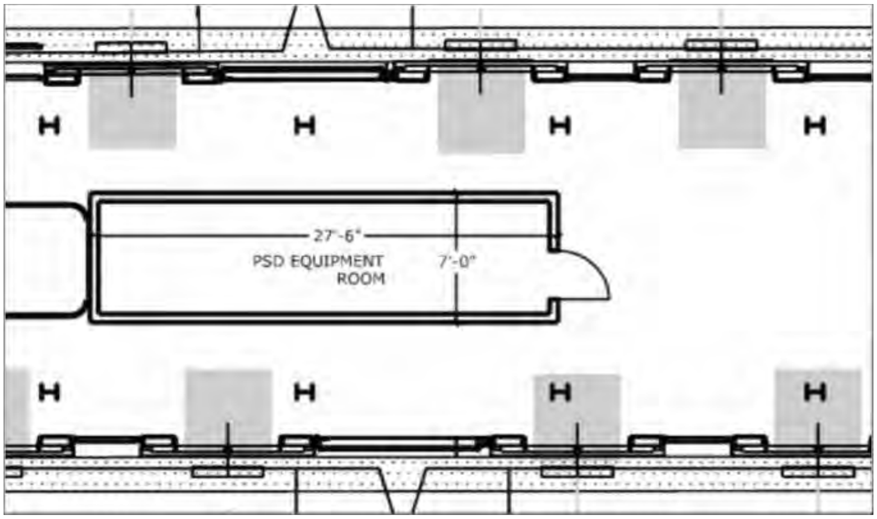


***Figure 2** – PSD Equipment Room 1 Detail*
7th Avenue Station

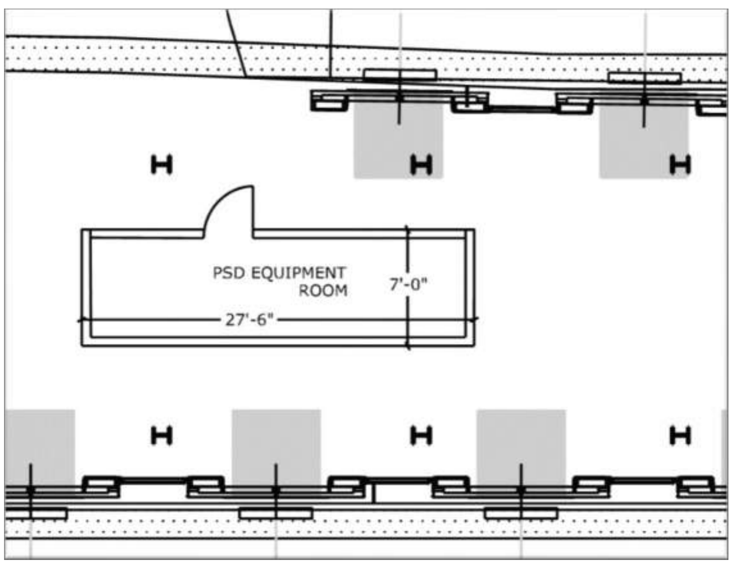


***Figure 3** – PSD Equipment Room 2 Detail*
7th Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:
This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	7th Avenue
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	78.0
Apparent Power (kVA)	97.5
Station Peak Demand Load, Max Current, (A)	270.8
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.8
Total Load (Station Peak + PSD), (A)	612
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	188
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram. Station has (2) separate meter reading, for each Normal & Reserve service. This analysis is for **Reserve service**.

***Table 1**- Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.5M to install APGs and $42.4M to install PSDs (See Appendix E)

Figure 4 *– Typical platform view with back of signal light*
7th Avenue Station

1.14 – MR 278 | Jamaica Center – Parsons/Archer Station

Summary: *Parsons Boulevard Station is feasible for both APGs and PSDs. In this two-level station, please note that only the upper platform was evaluated for this study since the E train stops at that level. Platform edge reconstruction would be required to support the requirements of an APG or a PSD system (see structural report; Appendix B). Existing power is adequate.*

Description

Jamaica Center – Parsons Archer is a below-grade station with two levels of center/island platforms **(see Figure 1)**. The platform structure is cast-in-place concrete. This report only covers the upper level platform as the lower level platform services the "J" line. The lower level will be reported on in a subsequent report. There are sparsely located columns throughout the station. These columns are either centered and measure 20'-10" apart on center, and their faces measure 11'-8" from the platform edges or the columns flank the escalators measure 25'-0" on center and their faces measure 4'-10" from the platform edge. The platform width is approximately 25'-0" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room could be located at the eastern end of the platform (**see Figure 1, Figure 2)**. The proposed room dimension is 27'-0" x 6-6".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

Reconstruction of the concrete platform edge will be required for the installation of an APG or PSD system due to the current platform edge condition rating. The 2012 NYCT conditions survey gave the platform edges an average rating of 3.375. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

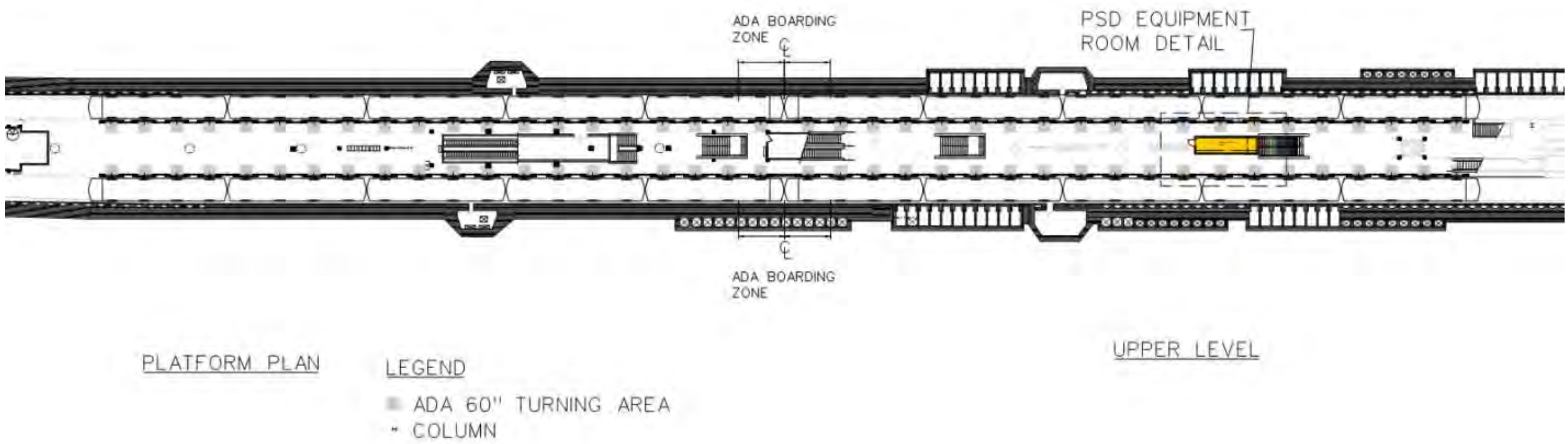


***Figure 1** – Overall Station Plan*
Jamaica Center – Parsons Archer Station

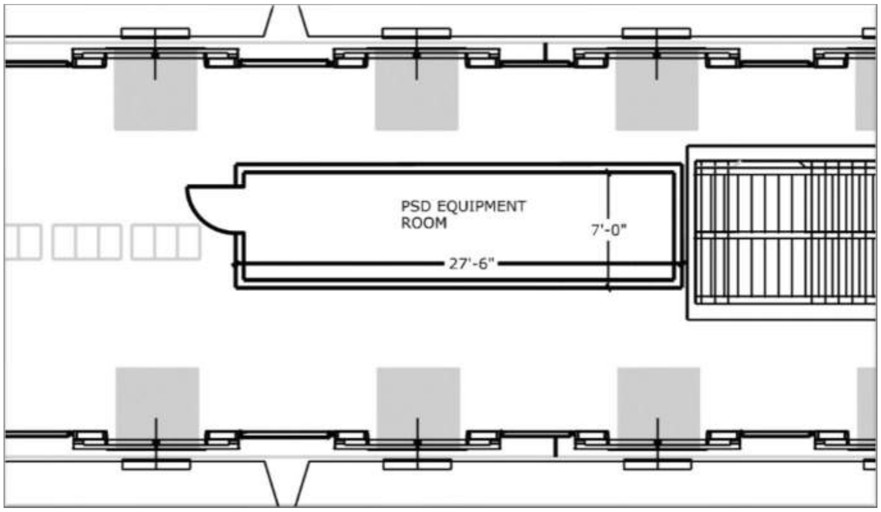


***Figure 2** – PSD Equipment Room 1 Detail*
Jamaica Center – Parsons Archer Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns at escalators

Northbound Track:

- Columns at escalators

These obstructions do not present an impediment to the installation of PSDs.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:
This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Jamaica Ctr. Parsons / Archer
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	688.3
Apparent Power (kVA)	860.4
Station Peak Demand Load, Max Current, (A)	2389.9
Maximum Amount of Doors	144.0
PSD Total Load Including All Miscellaneous Loads, (A)	317.2
Total Load (Station Peak + PSD), (A)	2707
Station Service Power Capacity, (Main SB or SG Rating), (A)	9000
Service Spare Capacity, (A)	6293
Is Electrical Service Adequate?	**Yes**
Notes	The analysis is based on field observed framed 1 line diagram located in Normal EDR. The station has only Normal EDR. The station has (2) service take offs (2 services) each at 4500 A rating and has (2)meters with combined reading.

Table 1- *Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.7M to install APGs and $42.3M to install PSDs (See Appendix E)

Figure 3 *– Typical platform view*
Jamaica Center – Parsons Archer Station

1.15 – MR 279 | Sutphin Boulevard Station

Summary: *Sutphin Boulevard Station is feasible for both APGs and PSDs. In this two-level station, please note that only the upper platform was evaluated for this study since the E train stops at that level. Platform edge reconstruction would be required to support the requirements of an APG or a PSD system (see structural report; Appendix B). Existing power is adequate.*

Description

Sutphin Boulevard Station is a below-grade station with two levels of center/island platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center. At the upper level platform, column faces are typically 5'-4" from the platform edge and the platform measures 29'-4" wide throughout save for a slight taper to 24'-6" at the eastern end of the platform. At the lower level platform column faces typically measure 2'-8" from the Queens-bound platform edge and 3'-10" from the Manhattan-bound platform edge. The platform width varies from 21'-8" to 24'-8" save for a slight taper to 13'-0" at the western end. On the lower platform there are four ceiling mounted signals located above the platform edge, measuring no less than 7'-4" above the ground. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Ceiling mounted signals located above the platform edge would need to be relocated in the implementation of full height PSDs**.**

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

Since there are 2 platform edges dedicated to the E train at this station, 1 full size equipment room would be required. The equipment room could be located at the eastern end of the upper level platform (**see Figure 1, Figure 2 & Figure 3).** The proposed room dimensions are 27'-0" x 6'-6" each.

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

Reconstruction of the concrete platform edge will be required for the installation of an APG or PSD system due to the current platform edge condition rating. The 2012 NYCT conditions survey gave the platform edges an average rating of 2.875. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

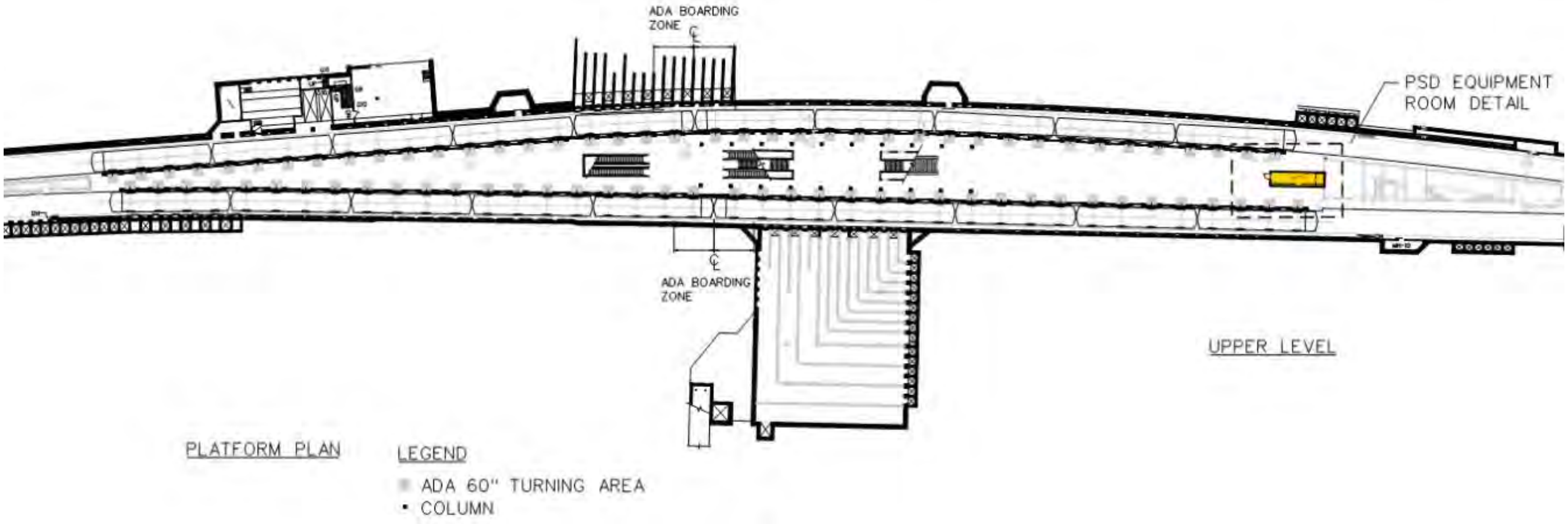


***Figure 1** – Overall Station Plan*
Sutphin Boulevard Station

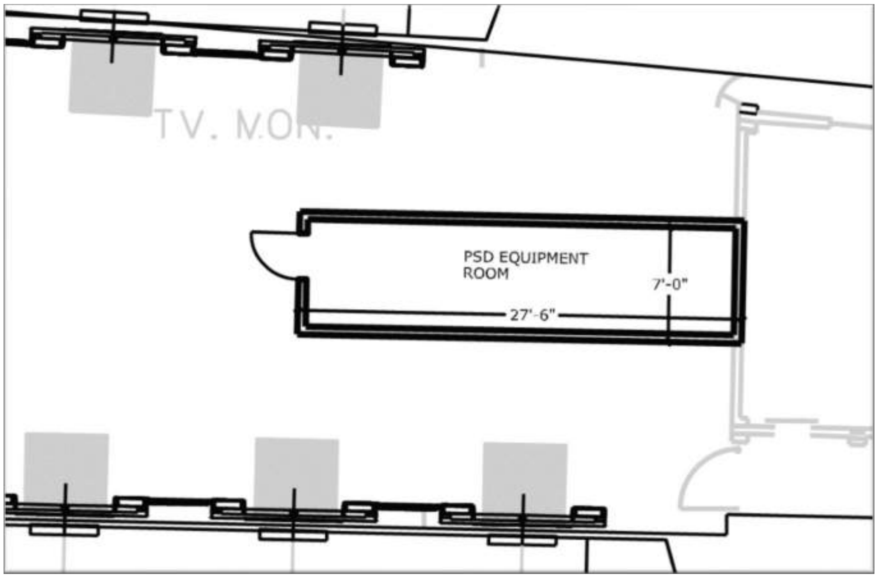


***Figure 2** – PSD Equipment Room 1 Detail*
Sutphin Boulevard Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns at escalators / stairs

Northbound Track:

- Columns at escalators / stairs

These obstructions do not present an impediment to the installation of PSDs.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:
This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Sutphin Blvd Archer Ave
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	520.0
Apparent Power (kVA)	650.0
Station Peak Demand Load, Max Current, (A)	1805.8
Maximum Amount of Doors	144.0
PSD Total Load Including All Miscellaneous Loads, (A)	317.2
Total Load (Station Peak + PSD), (A)	2123
Station Service Power Capacity, (Main SB or SG Rating), (A)	17705.33
Service Spare Capacity, (A)	15582
Is Electrical Service Adequate?	**Yes**
	Station Normal EDR has (2) separate 460 Volt Services each with its own meter & combined meter reading. The rating data is converted to 208 V units. Reserve EDR has (1)service rated at 208 V. The meter reading is zero. The analysis is based on Normal service field observations.

Table 1*- Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.7M to install APGs and $40.6M to install PSDs (See Appendix E)

***Figure 3** – Typical platform view with back of signal light*
Sutphin Boulevard Station

1.16 – MR 280 | Jamaica Van Wyck Station

Summary: *Jamaica Van Wyck Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG or a PSD system (see structural report; Appendix B). Existing power is adequate.*

Description

Jamaica Van Wyck Station is a below-grade station with one center/island platform **(see Figure 1)**. The platform structure is cast-in-place concrete. There are no columns throughout the platform **(see Figure 3),** save for 6 columns toward the southern end of the platform, these columns measure 14'-4" apart on center, and their faces measure 4'-10" from the platform edges. The platform width is approximately 24'-6" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room could be located at the eastern end of the platform (**see Figure 1, Figure 2)**. The proposed room dimension is 16'-6" x 6-6".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, reconstruction of the concrete platform edge should be required for the installation of an APG or PSD system due to the current platform edge condition rating. The 2012 NYCT conditions survey gave the platform edges an average rating of 3. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

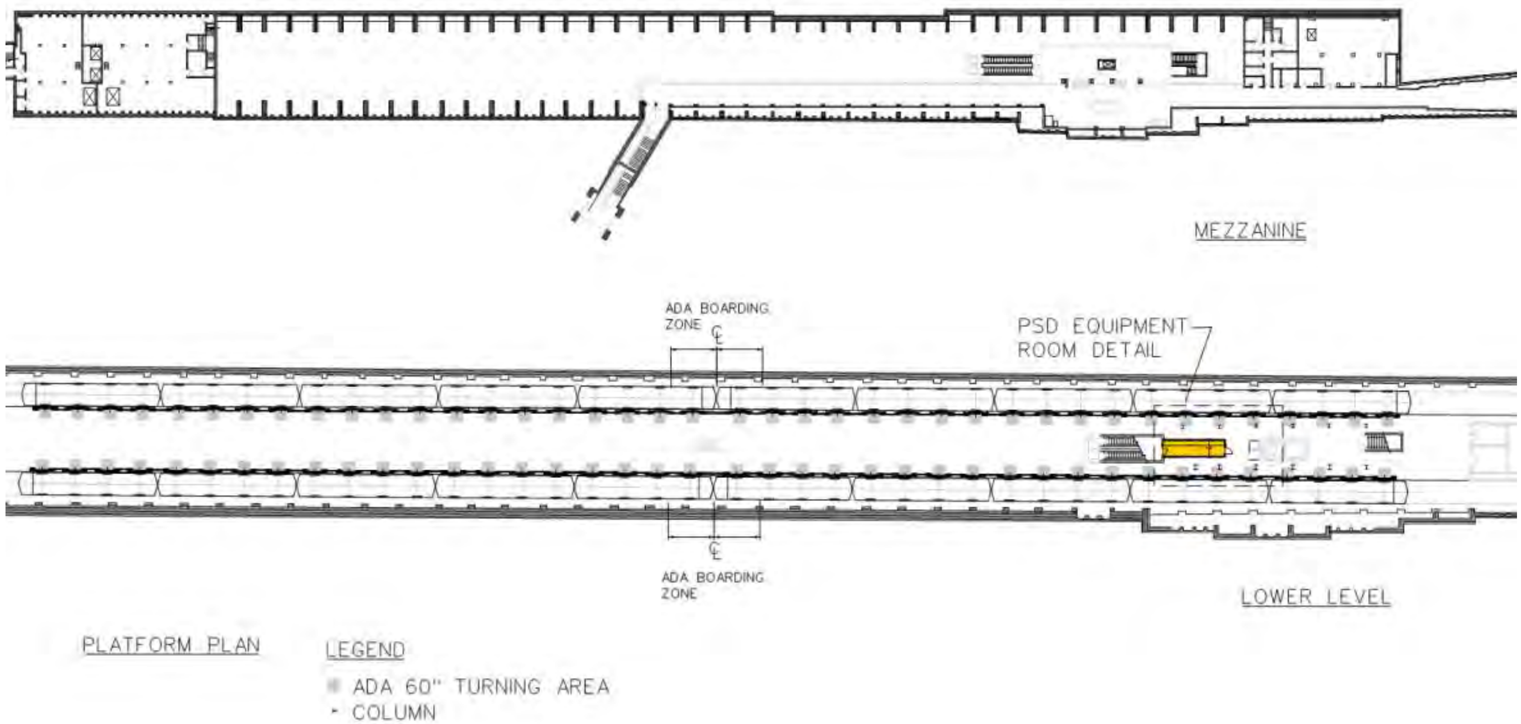


***Figure 1** – Overall Station Plan*
Jamaica Van Wyck Station

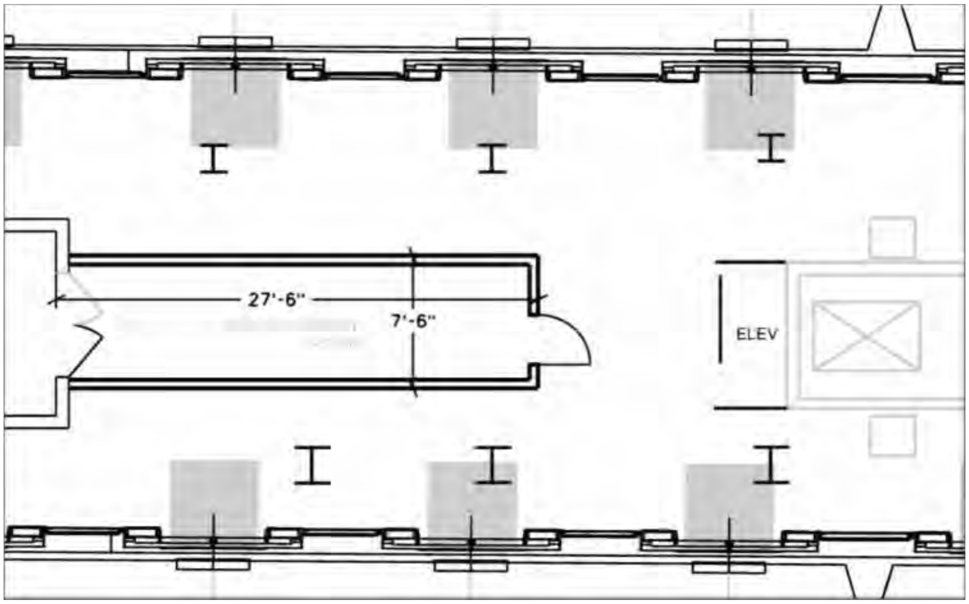


Figure 2 *– PSD Equipment Room 1 Detail*
Jamaica Van Wyck Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns only at end of platform

Northbound Track:

- Columns only at end of platform

These obstructions do not present an impediment to the installation of PSDs.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:
This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Jamaica Van Wyck
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	81.6
Apparent Power (kVA)	102.0
Station Peak Demand Load, Max Current, (A)	283.3
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	478
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	322
Is Electrical Service Adequate?	**Yes**
Notes	The analysis is based on 1 line diagram. Station has (2) separate meter readings for each normal & reserve service. This analysis is for **Reserve service**. The Reserve service is 208 volt and not 4160 volt as shown at 1 line diagram.

Table 1- *Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.5M to install APGs and $40.4M to install PSDs (See Appendix E)

***Figure 3** – Typical platform view*
Jamaica Van Wyck Station

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*
>
> a. *Column location in relation to the platform edge*
> b. *Platform edge clearance adjacent to stairs and other impediments*
> c. *Impacts to ADA path of travel and boarding areas*
> d. *Conflicts of PSD/APG/RPSDs with Signals cables*
> e. *Sufficient platform width*
> f. *Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*
>
> a. *Structural capacity of platforms to accept PSD/APG/RPSDs*
> b. *Feasibility & location for PSD/APG/RPSDs equipment room*
> c. *Confirmation of adequate power for PSD/APG/RPSDs*
> d. *Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> e. *Determination of communications requirements, availability and cost*
> f. *Determination of gap detection and entrapment avoidance technology requirements*
> g. *Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
    - Double the amount of motors as PSDs (each motor operating a single leaf).
    - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
    - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
    - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY. Status of doors will be provided to crew via indicator lights, with no automated propulsion cutout.

If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

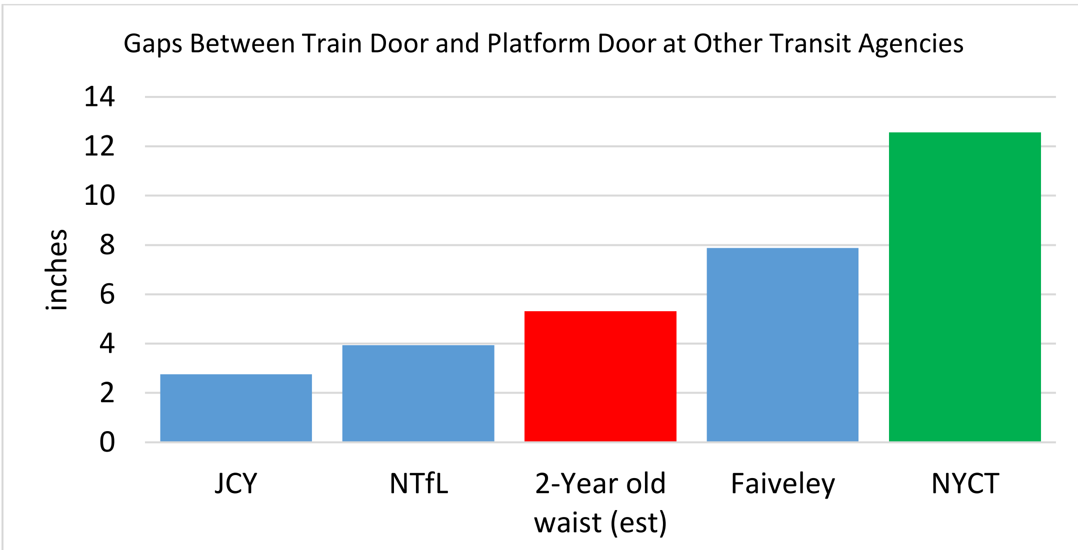


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

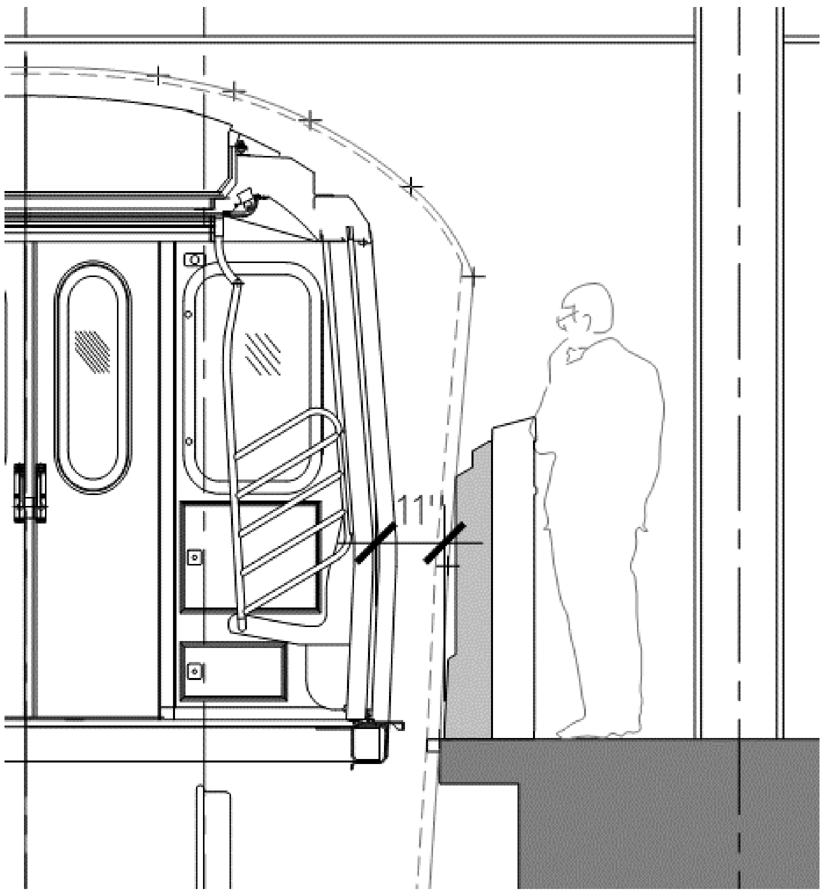


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber “bumpers” on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6” into the line equipment envelope. This would leave a 5” gap between the platform and car doors allowing approximately 2” of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5" by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor's window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor's window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **<u>bold/underline</u>**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	PSD System 1	PSD System 2	PSD System 3
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are “existing” as defined by code. All the rolling stock is also to be considered “existing” under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60” radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36” of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

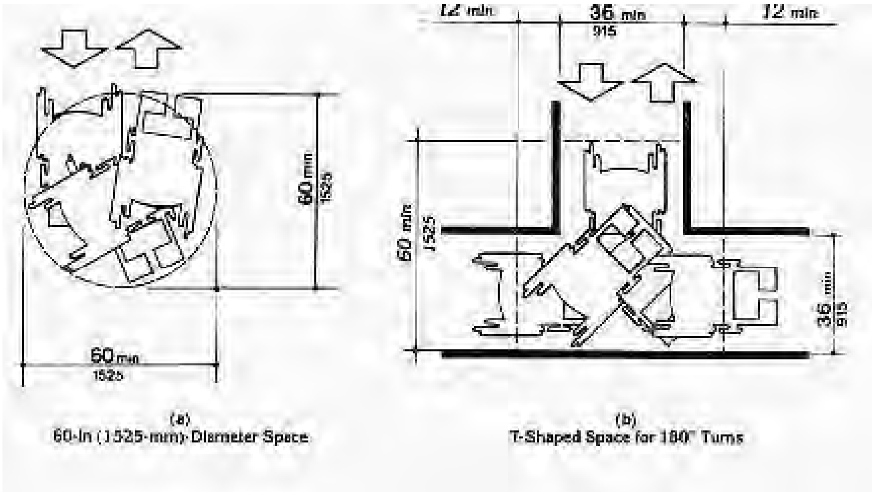
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

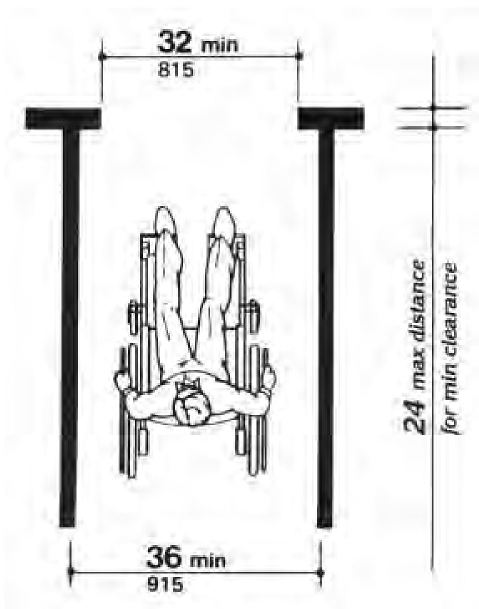


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

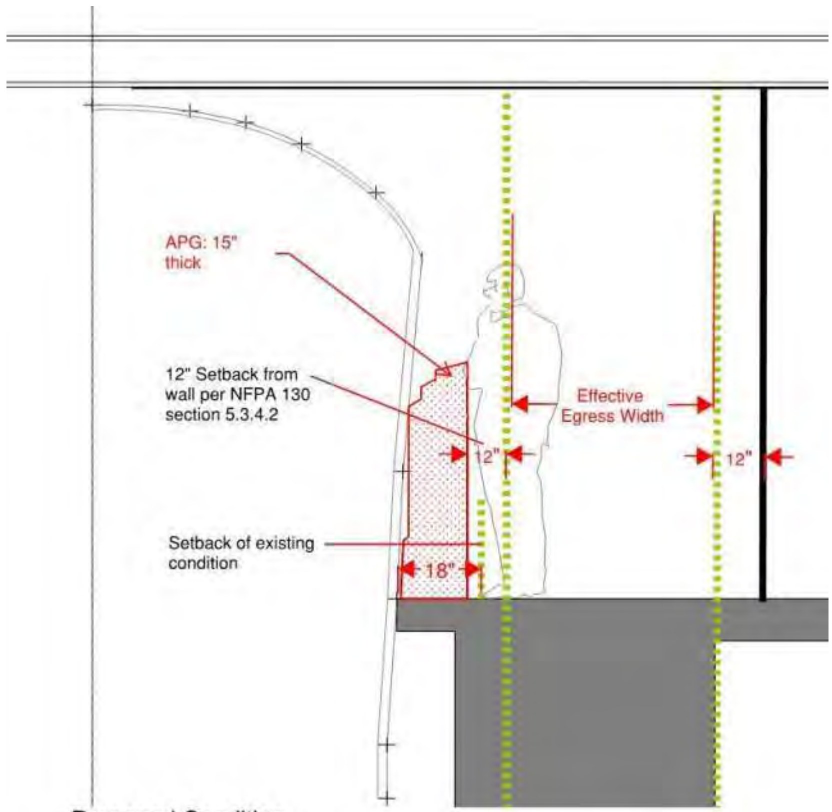
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15” of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

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Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

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Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	**Dedicated Loop**	**Wayside Only**
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	**CBTC**		**Dedicated loop**		**Wayside only**	
		Qty.	**subtotal**	**Qty.**	**subtotal**	**Qty.**	**subtotal**
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

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DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

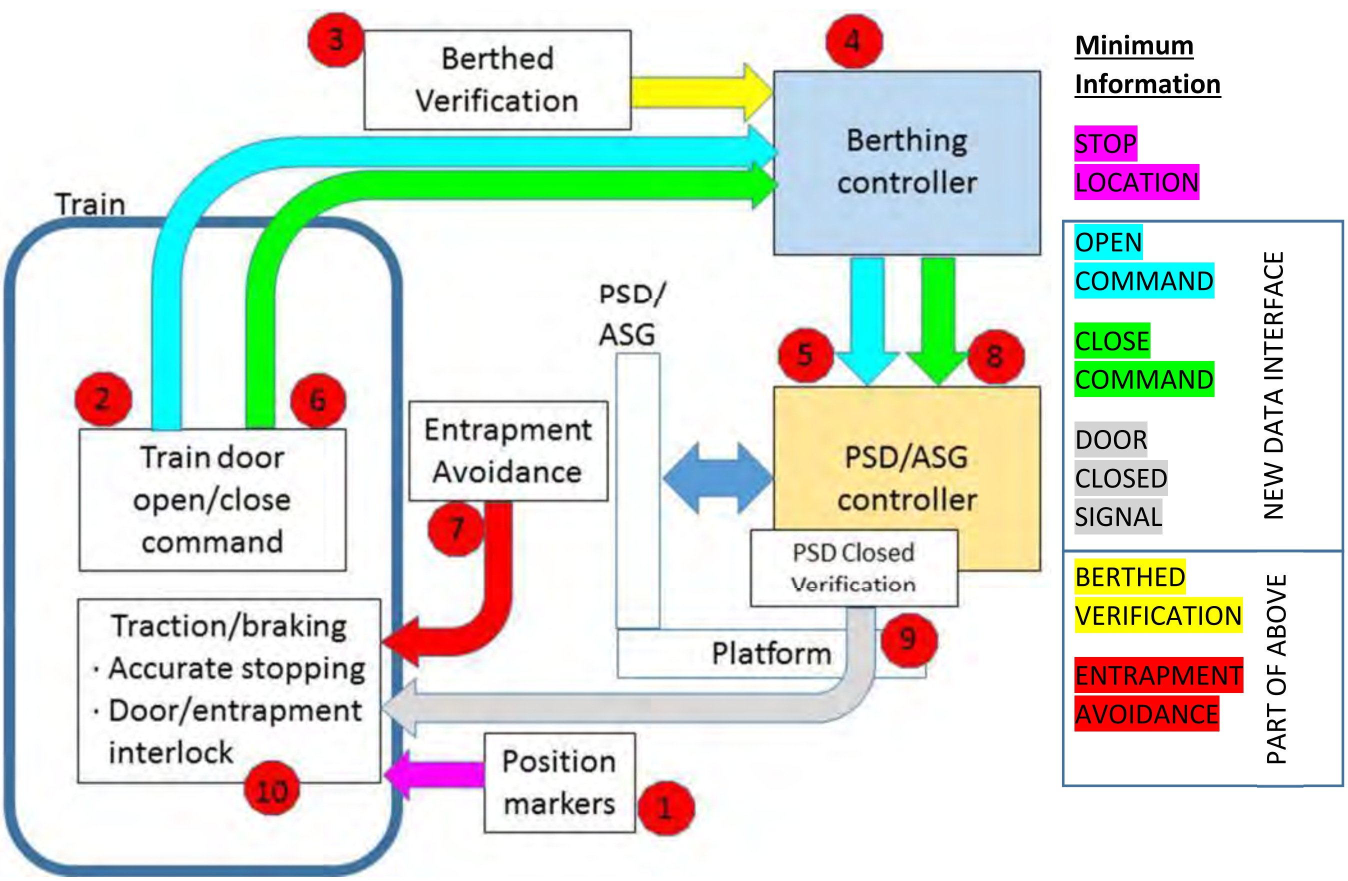
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



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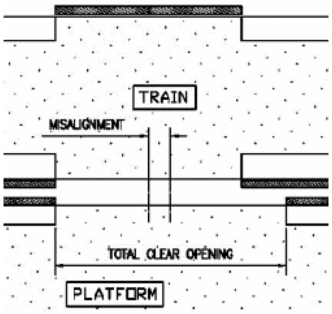
Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5" clear opening, a design for NY should meet the ADA Accessibility Guideline of 36".

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a 'distance totem' which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy's COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

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Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

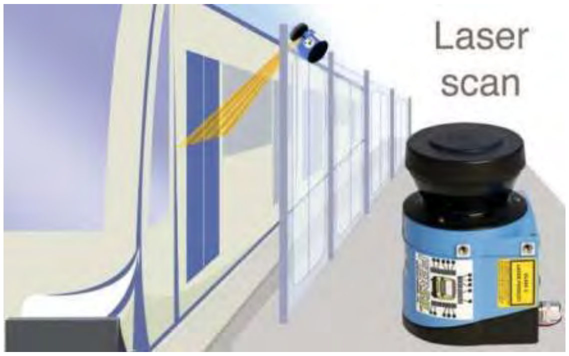
The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically

If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.



For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4'-0"). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

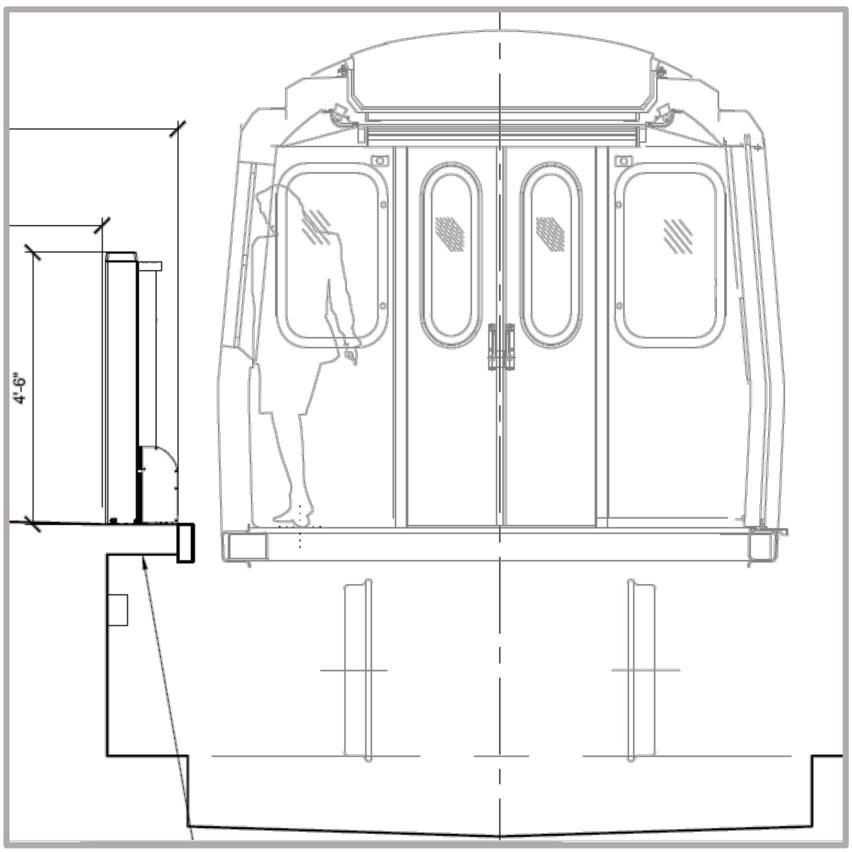


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

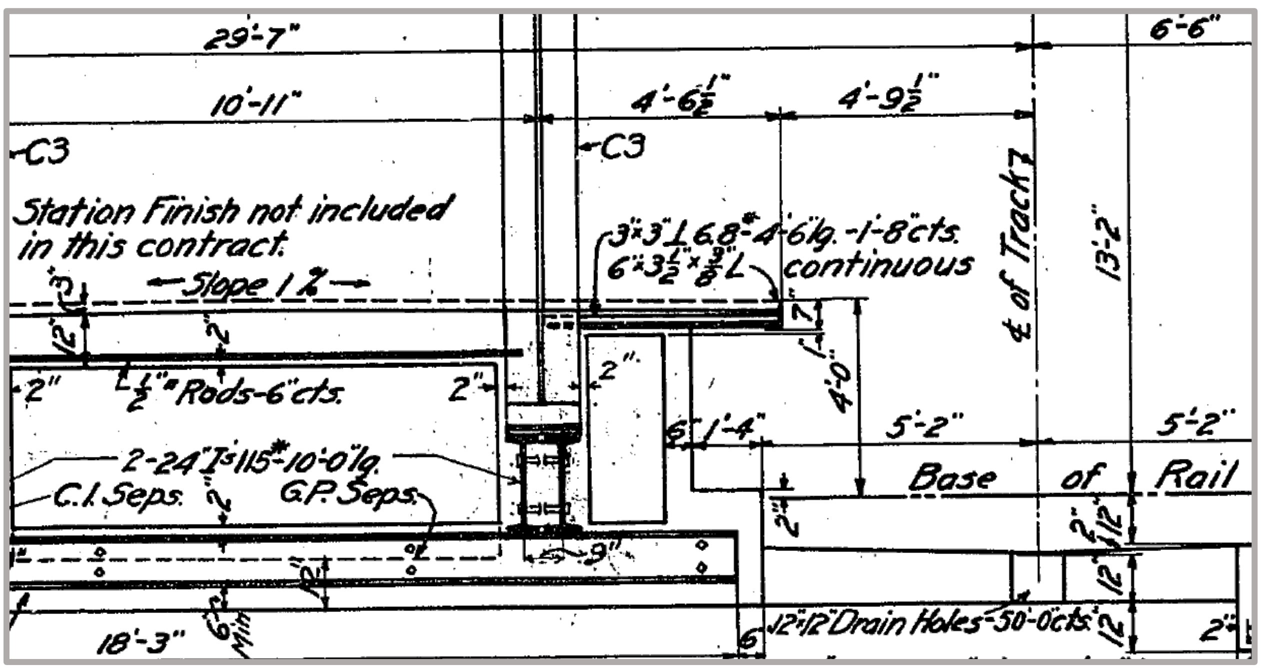


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

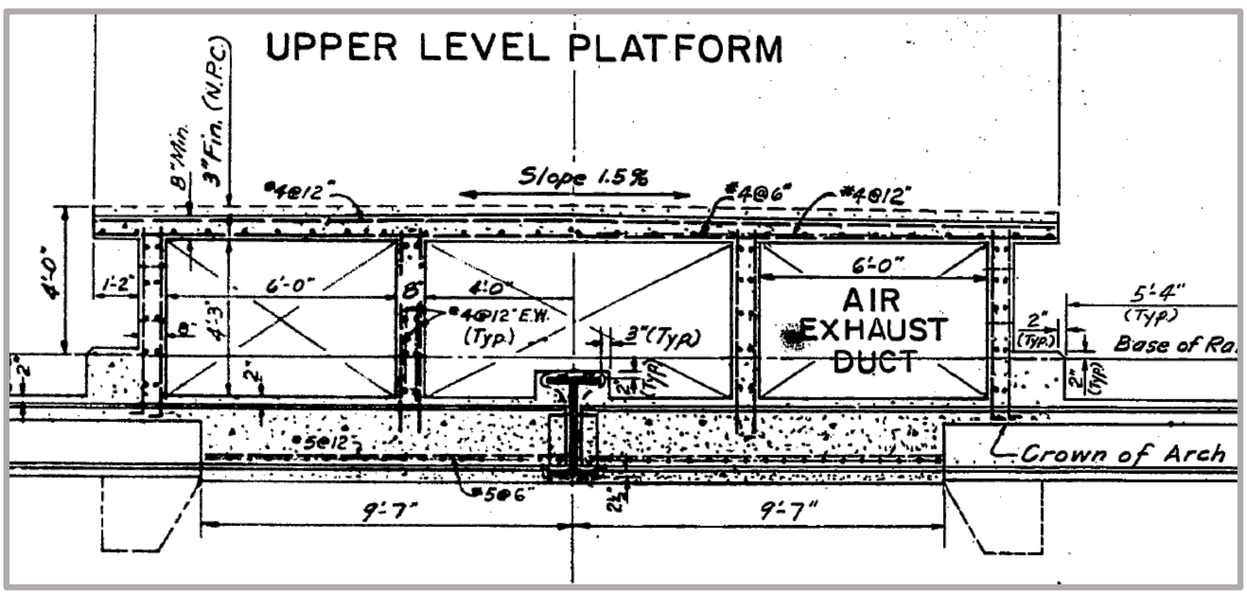


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

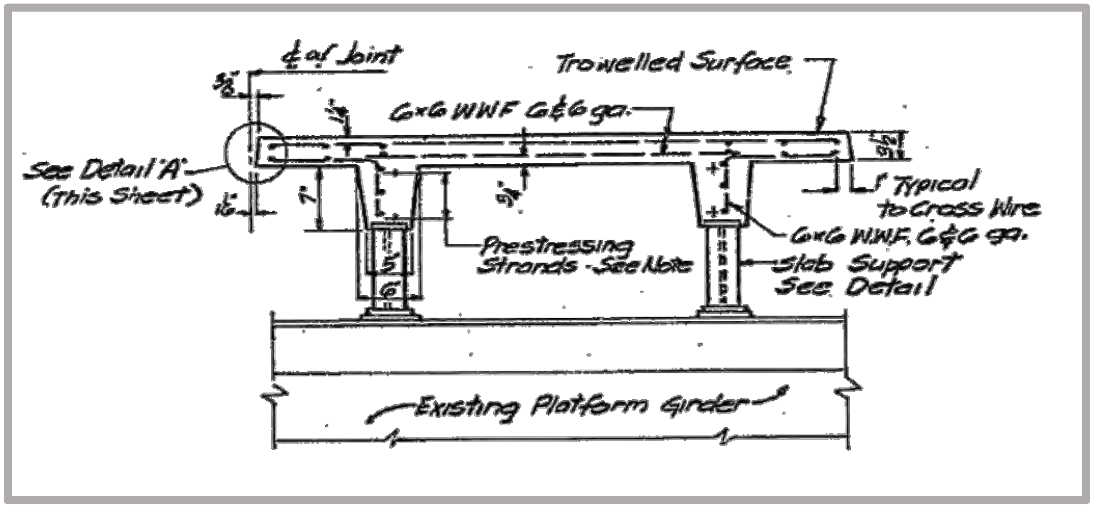


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

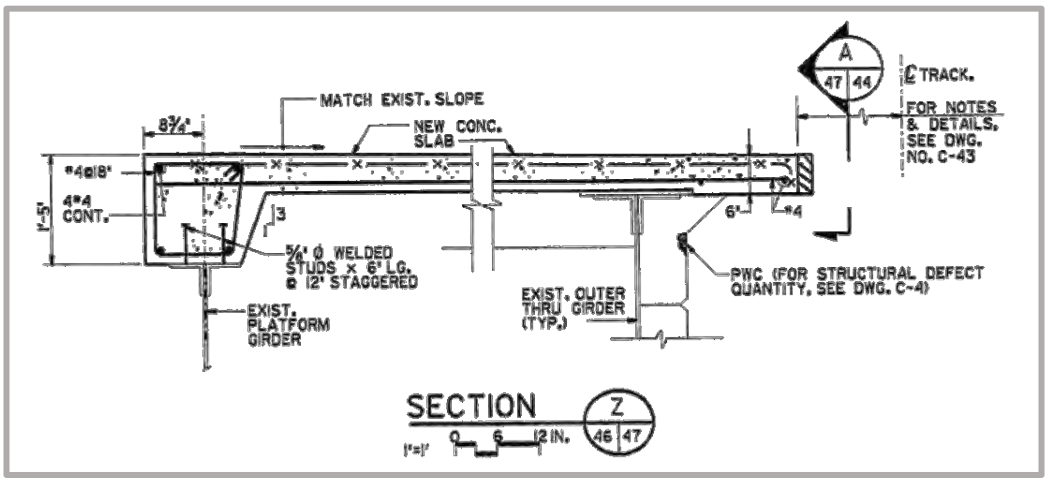


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2'-9"), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

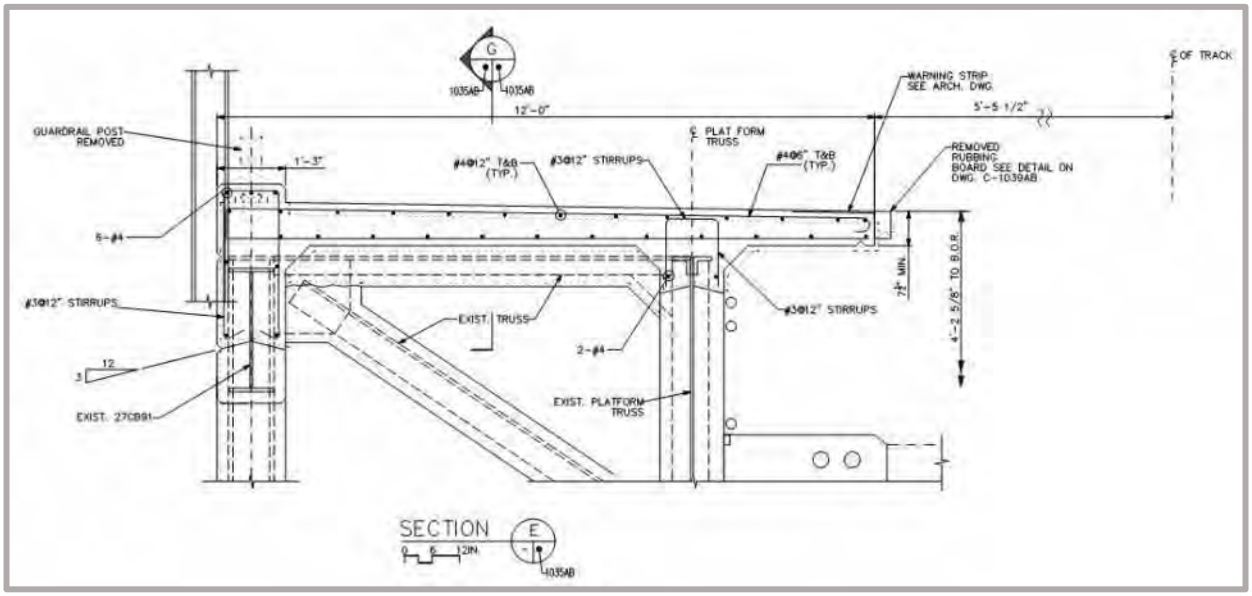


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3” thick structural slab with an approximately 3” thick topping slab. If the topping slab is fully removed, a 6” thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6” thick slab will be sufficient for a cantilever length of up to approximately 3’-0”, greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6” structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6” minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

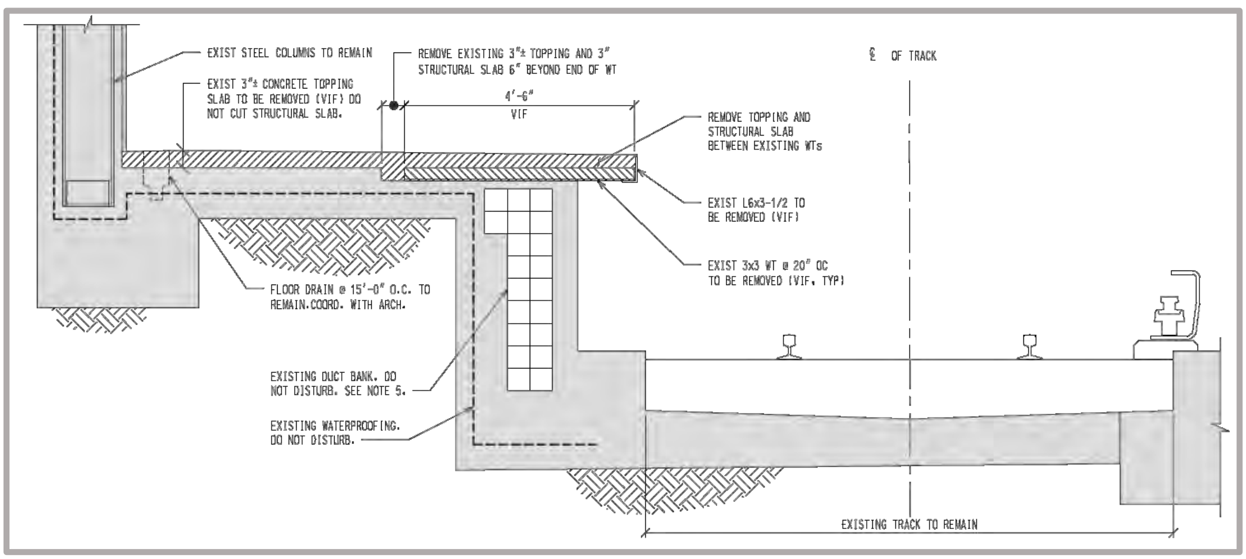


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

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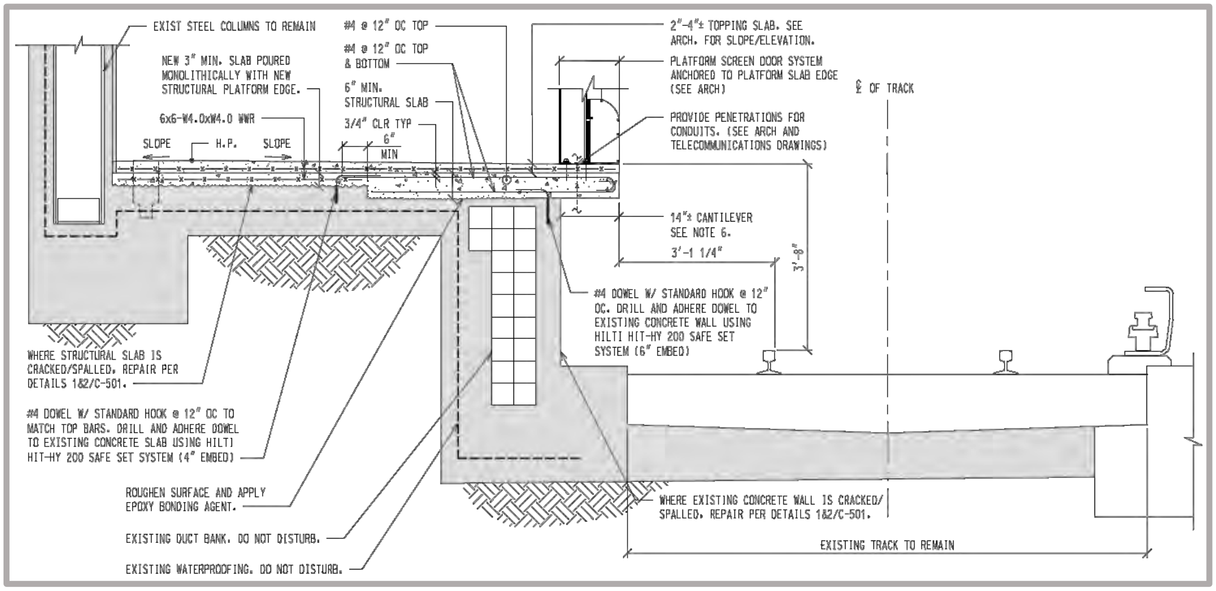


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

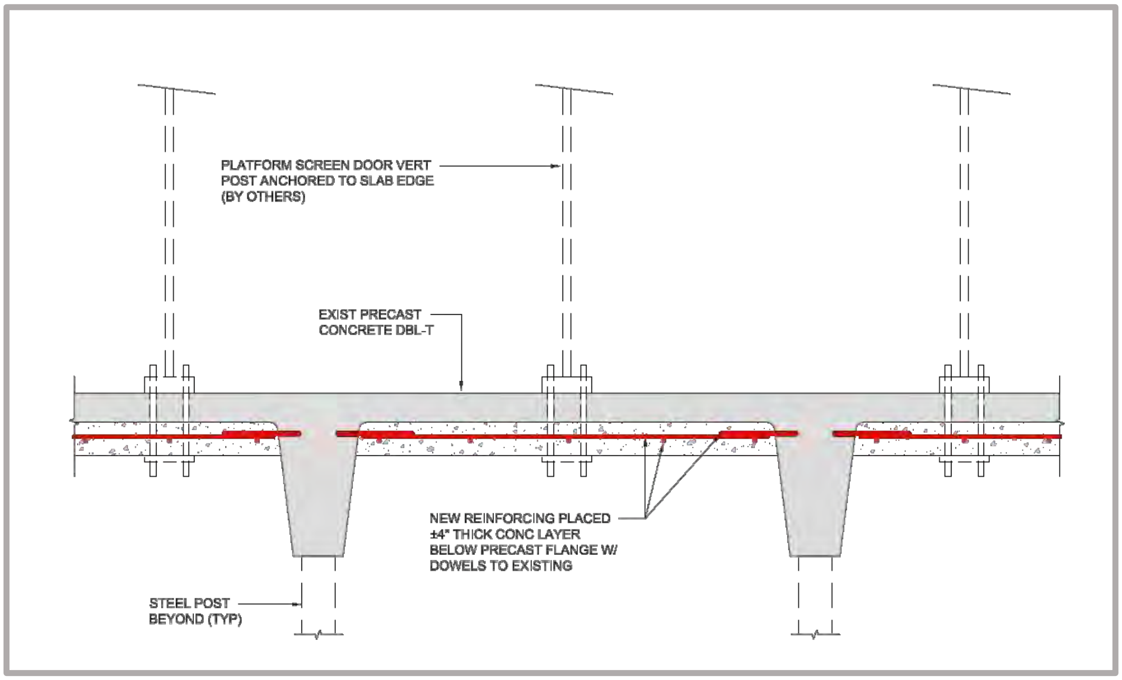


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

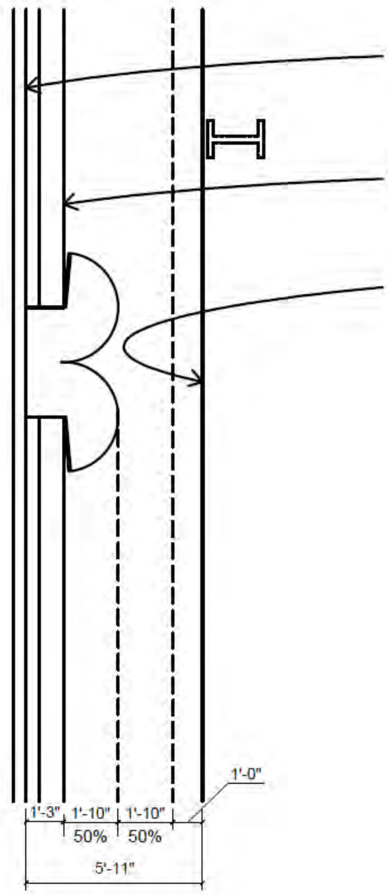
The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5' – 11" of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis



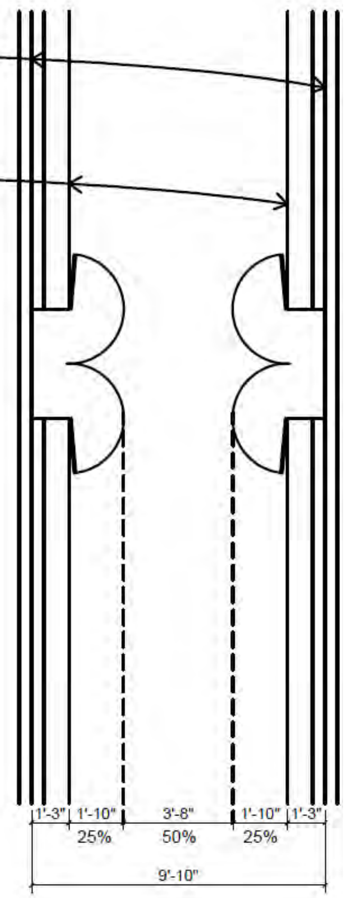


FIGURE 1: SIDE PLATFORM

FIGURE 2: CENTER PLATFORM

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

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MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	9	$ 63,500 per month [Year 01]	$ 571,500		
		12	$ 83,590 per month [Year 02]	$ 1,003,080		
		12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment.	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
		12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663		

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT
7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *	
		Year 3	$ 257 per hour *	
	Optional :	Year 4	$ 268 per hour *	
	Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

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ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations
ESTIMATE DATE:	September 27, 2018

VJ ASSOCIATES
ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

MTA/NYCT

September 27, 2018

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.2 *APGs / PSDs will provide 39 emergency egress doors with push bars per platform*
1.3 *Each platform edge will have 50 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 It is assumed that each train has 10 cars on this line
2.2 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.3 In respect of the PSD option, only platforms that have not been upgraded in the recent past will require platform edge replacement.
2.4 There are no special security requirements made necessary by installation of the APG system
2.5 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.6 This estimate does not provide for the replacement of Platform Edge Lighting
2.7 Premium cost for night time work is considered 50% of total labor cost

VJ ASSOCIATES
ORDER OF MAGNITUDE COSTS
ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

MTA/NYCT

September 27, 2018

BASIS OF ESTIMATE

3.0 ***Exclusions - Costs not included in the estimate:***

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems
3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length
3.4 Costs associated with NYCT State Of Good Repair improvements to the station
3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.
3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs
3.7 Escalation Cost is not included; Anticipate at 5% per annum.
3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.
3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium
3.10 NYCT project cost is not included
3.11 GO and flagging cost is not included
3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or "soft" costs:***

4.1 Design and Construction Contingency
4.2 Contractor O & P
4.3 Insurance
4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 Given the limited time available, no drawings were developed to support this estimate.

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MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations
IRT Flushing Line Stations

September 27, 2018

ORDER OF MAGNITUDE COSTS			MR-162	MR-164	MR-165	MR-166	MR-167	MR-168	MR-169	MR-171	MR-277	MR-278	MR-279	MR-280
	DESCRIPTION		50TH STREET	34TH STREET PENN STATION	23RD STREET	14TH STREET	WEST 4TH STREET	SPRING STREET	CANAL STREET	WORLD TRADE CENTER	7TH AVENUE	JAMAICA CTR PARSONS / ARCHER	SUTPHIN BLVD ARCHER AVE	JAMAICA VAN WYCK
1	AUTOMATIC PLATFORM GATES (APG'S)		$17,872,850	$17,202,050	$17,194,250	$17,303,307	$17,403,214	$17,241,050	$17,155,105	$17,285,250	$17,244,660	$17,337,467	$16,794,493	$16,693,093
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$17,872,850	$17,202,050	$17,194,250	$17,303,307	$17,403,214	$17,241,050	$17,155,105	$17,285,250	$17,244,660	$17,337,467	$16,794,493	$16,693,093
4	GENERAL REQUIREMENTS	15.00%	$2,680,927	$2,580,307	$2,579,137	$2,595,496	$2,610,482	$2,586,157	$2,573,266	$2,592,787	$2,586,699	$2,600,620	$2,519,174	$2,503,964
	SUB-TOTAL:		$20,553,777	$19,782,357	$19,773,387	$19,898,803	$20,013,696	$19,827,207	$19,728,371	$19,878,037	$19,831,360	$19,938,087	$19,313,667	$19,197,057
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$5,138,444	$4,945,589	$4,943,347	$4,974,701	$5,003,424	$4,956,802	$4,932,093	$4,969,509	$4,957,840	$4,984,522	$4,828,417	$4,799,264
	SUB-TOTAL:		$25,692,222	$24,727,947	$24,716,734	$24,873,503	$25,017,120	$24,784,009	$24,660,463	$24,847,547	$24,789,199	$24,922,609	$24,142,084	$23,996,322
6	OVERHEAD & PROFIT	15.00%	$3,853,833	$3,709,192	$3,707,510	$3,731,026	$3,752,568	$3,717,601	$3,699,069	$3,727,132	$3,718,380	$3,738,391	$3,621,313	$3,599,448
	SUB-TOTAL:		$29,546,055	$28,437,138	$28,424,244	$28,604,529	$28,769,688	$28,501,610	$28,359,533	$28,574,678	$28,507,579	$28,661,000	$27,763,397	$27,595,770
7	BONDS & INSURANCE	3.75%	$1,107,977	$1,066,393	$1,065,909	$1,072,670	$1,078,863	$1,068,810	$1,063,482	$1,071,550	$1,069,034	$1,074,787	$1,041,127	$1,034,841
	SUB-TOTAL:		$30,654,032	$29,503,531	$29,490,153	$29,677,199	$29,848,551	$29,570,421	$29,423,015	$29,646,229	$29,576,614	$29,735,787	$28,804,524	$28,630,611
	SUB-TOTAL:		$30,654,032	$29,503,531	$29,490,153	$29,677,199	$29,848,551	$29,570,421	$29,423,015	$29,646,229	$29,576,614	$29,735,787	$28,804,524	$28,630,611
	SUBTOTAL CONSTRUCTION COST W/O ACM		$30,654,032	$29,503,531	$29,490,153	$29,677,199	$29,848,551	$29,570,421	$29,423,015	$29,646,229	$29,576,614	$29,735,787	$28,804,524	$28,630,611
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		$30,654,032	$29,503,531	$29,490,153	$29,677,199	$29,848,551	$29,570,421	$29,423,015	$29,646,229	$29,576,614	$29,735,787	$28,804,524	$28,630,611
10	DESIGN CONSULTANT FEES	10.00%	$3,065,403	$2,950,353	$2,949,015	$2,967,720	$2,984,855	$2,957,042	$2,942,302	$2,964,623	$2,957,661	$2,973,579	$2,880,452	$2,863,061
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST		$33,719,435	$32,453,884	$32,439,169	$32,644,919	$32,833,406	$32,527,463	$32,365,317	$32,610,852	$32,534,275	$32,709,366	$31,684,976	$31,493,672
	ADD ALTERNATIVES													
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		5,062,897	4,361,919	4,637,519	5,492,583	4,550,700	5,029,201	6,252,321	5,242,297	$5,227,108	$5,078,760	$4,740,276	$4,740,276
	Add for Markups (as above)	88.7%	4,488,910	3,867,404	4,111,759	4,869,883	4,034,782	4,459,035	5,543,488	4,647,972	4,634,505	4,502,975	4,202,866	4,202,866
			$9,551,807	$8,229,323	$8,749,278	$10,362,467	$8,585,482	$9,488,235	$11,795,809	$9,890,268	$9,861,614	$9,581,735	$8,943,142	$8,943,142

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 50TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE LOWER PLATFORM EDGE [SOUTH BOUND] =	660	LF		
5	LENGTH OF THE LOWER PLATFORM EDGE [NORTH BOUND] =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,320**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 50TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room - Lower Platform [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,655	SF	750	1,991,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	246,135	246,135
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,500,000	1,500,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 50TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	450	LF	60	27,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	500	LF	60	30,000
76	Allowance for power to cross tracks to opposite platform [Lower Level]	1	LS	15,000	15,000
77	No allowance for new lighting as if APG's are used		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	2,000	Hrs	160	319,860
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 50TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	**Training**				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	**Out of hours Work**				
112	Allow loss of production to work at night say 50%	1	LS	4,124,504	4,124,504
114	**TOTAL PSD WORK:**				**$ 17,872,850**

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	5,694	SF	750	4,270,365
127	Spare Parts - Approx. 10% of Material Cost	1	LS	454,342	454,342
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
130	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
131	Drilling and bolting - 4 bolts at each connection	528	EA	216	114,048
132	Platform Edge Repair				
133	Remove concrete platform edge	1,320	LF	27	35,640
134	Platform edge repair	1,320	LF	109	143,880
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
136	Signal Work [Each 300' length is associated with one signal light]				
137	Disconnects	80	HRS	162	12,960
138	Remove signal cables	600	LF	40	24,000
139	Carefully remove existing conduit; Assuming 1"	600	LF	55	33,000
140	Install existing conduit in new position	600	LF	110	66,000
141	Install replacement cable; assumed single cable #12	600	LF	125	75,000
142	Re-commission / testing as required	2	EA	12,500	25,000
143	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
144	Premium Time	1,569	HRS	49	76,253

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 50TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,655)	SF	750	(1,991,250)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,135	(246,135)
153	Platform Edge Reconstruction work	(1)	LS	593,000	(593,000)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,168,361	1,168,361
158					
159	**PREMIUM ASSOCIATED WITH PSD's**				**5,062,897**

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 34TH STREET PENN STATION

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	660	LF		
5	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,320**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 34TH STREET PENN STATION

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room - Upper Platform [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,655	SF	750	1,991,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	246,135	246,135
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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STATION: 34TH STREET PENN STATION

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	200	LF	60	12,000
76	Allowance for power to cross tracks to opposite platform; 4 Tracks between Platforms	1	LS	35,000	35,000
77	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	2,000	Hrs	160	319,860
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 34TH STREET PENN STATION

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	3,969,704	3,969,704
114	TOTAL PSD WORK:				$ 17,202,050

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	5,694	SF	750	4,270,365
127	Spare Parts - Approx. 10% of Material Cost	1	LS	454,342	454,342
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
130	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Platform Edge Repair				
133	Remove concrete platform edge	-	LF	27	-
134	Platform edge repair	-	LF	109	-
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	-	EA	10	-
136					
137	OMIT				
138	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
139	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
140	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 34TH STREET PENN STATION

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
141	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
142	Fixed Panels including framing and support; 4'-6" High	(2,655)	SF	750	(1,991,250)
143	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,135	(246,135)
144	Platform Edge Reconstruction work	(1)	LS	593,000	(593,000)
145	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
146	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
147					
148	Allow loss of production to work at night say 50%	1	LS	1,006,597	1,006,597
149					
150	**PREMIUM ASSOCIATED WITH PSD's**				**4,361,919**

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 23RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	660	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,320**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 23RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,655	SF	750	1,991,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	246,135	246,135
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 23RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	Allowance for power to cross tracks to opposite platform; 4 Tracks between Platforms	1	LS	35,000	35,000
77	No allowance for new lighting as if APG's are used		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	2,000	Hrs	160	319,860
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 23RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	3,967,904	3,967,904
113					
114	TOTAL PSD WORK:				$ 17,194,250

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	5,694	SF	750	4,270,365
127	Spare Parts - Approx. 10% of Material Cost	1	LS	454,342	454,342
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
130	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
131	Drilling and bolting - 4 bolts at each connection	528	EA	216	114,048
132	Platform Edge Repair				
133	Remove concrete platform edge	1,320	LF	27	35,640
134	Platform edge repair	1,320	LF	109	143,880
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
136					
137	OMIT				
138	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
139	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
140	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
141	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 23RD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Fixed Panels including framing and support; 4'-6" High	(2,655)	SF	750	(1,991,250)
143	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,135	(246,135)
144	Platform Edge Reconstruction work	(1)	LS	593,000	(593,000)
145	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
146	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
148	Allow loss of production to work at night say 50%	1	LS	1,070,197	1,070,197
149					
150					
151	**PREMIUM ASSOCIATED WITH PSD's**				**4,637,519**

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 14TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	670	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	670	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,340**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,340	LF	7	9,380
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,700	SF	12	80,400
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	135	CY	2,500	337,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,342	EA	25	33,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,342	EA	25	33,550
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,340	LF	95	127,300
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,340	LF	15	20,100
26	Remove existing platform tiles	1,340	LF	12	16,080
27	Sawcut existing topping concrete at perimeter of removal area	1,340	LF	5	6,700
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,040	SF	8	64,320
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,340	SF	15	20,100

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 14TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,745	SF	750	2,058,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	250,185	250,185
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 14TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,340	LF	60	80,400
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	Allowance for power to cross tracks to opposite platform; 4 Tracks between Platforms	1	LS	35,000	35,000
77	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	2,000	Hrs	160	319,860
98	Centralized monitoring/control	.			
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 14TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	3,993,071	3,993,071
114	TOTAL PSD WORK:				$ 17,303,307

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	5,854	SF	750	4,390,365
127	Spare Parts - Approx. 10% of Material Cost	1	LS	461,542	461,542
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	88,843
130	L6x6x1/2 continuous angle	10	TONS	17,500	172,592
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Platform Edge Repair				
133	Remove concrete platform edge	-	LF	27	-
134	Platform edge repair	-	LF	109	-
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	-	EA	10	-
136	Signal Work [Each 300' length is associated with one signal light]				
137	Disconnects	200	HRS	162	32,400
138	Remove signal cables	1,500	LF	40	60,000
139	Remove conduit; Assuming 1"	1,500	LF	55	82,500
140	Install conduit in new position	1,500	LF	110	165,000
141	Install replacement cable; assumed single cable #12	1,500	LF	125	187,500
142	Re-commission / testing as required	5	EA	12,500	62,500

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 14TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
143	Engineering / Shop Drawings / Etc.	5	EA	7,500	37,500
144	Premium Time	3,922	HRS	49	190,609
145					
146	**OMIT**				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,745)	SF	750	(2,058,750)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	250,185	(250,185)
153	Platform Edge Reconstruction work	(1)	LS	600,200	(600,200)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,340)	LF	30	(40,200)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,267,519	1,267,519
158					
159	**PREMIUM ASSOCIATED WITH PSD's**				**5,492,583**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: WEST 4TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE UPPER PLATFORM EDGE [NORTH BOUND] =	660	LF		
5	LENGTH OF THE UPPER PLATFORM EDGE [SOUTH BOUND] =	679	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,339**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,339	LF	7	9,373
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,695	SF	12	80,340
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	135	CY	2,500	337,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,341	EA	25	33,525
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,341	EA	25	33,525
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,339	LF	95	127,205
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,339	LF	15	20,085
26	Remove existing platform tiles	1,339	LF	12	16,068
27	Sawcut existing topping concrete at perimeter of removal area	1,339	LF	5	6,695
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,034	SF	8	64,272
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	780	SF	8	6,240
30	New Work				
31	New concrete topping to match existing	1,339	SF	15	20,085

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: WEST 4TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	780	SF	15	11,700
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,741	SF	750	2,055,375
61	Spare Parts - Approx. 10% of Material Cost	1	LS	249,983	249,983
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: WEST 4TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,339	LF	60	80,340
72	PSD Connections	1	LS	150,000	150,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	Allowance for power to cross tracks to opposite platform [Upper Level]; 4 Tracks between Platforms	1	LS	35,000	35,000
77	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	2,000	Hrs	160	319,860
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: WEST 4TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	4,016,126	4,016,126
114	TOTAL PSD WORK:				$ 17,403,214

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	5,846	SF	750	4,384,365
127	Spare Parts - Approx. 10% of Material Cost	1	LS	461,182	461,182
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	88,778
130	L6x6x1/2 continuous angle	10	TONS	17,500	172,463
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Platform Edge Repair				
133	Remove concrete platform edge	660	LF	27	17,820
134	Platform edge repair	660	LF	109	71,940
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
136					
137	OMIT				
138	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
139	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
140	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: WEST 4TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
141	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
142	Fixed Panels including framing and support; 4'-6" High	(2,741)	SF	750	(2,055,375)
143	Spare Parts - Approx. 10% of Material Cost	(1)	LS	249,983	(249,983)
144	Platform Edge Reconstruction work	(1)	LS	600,090	(600,090)
145	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
146	Conduit running under Platform Edge	(1,339)	LF	30	(40,170)
147					
148	Allow loss of production to work at night say 50%	1	LS	1,050,161	1,050,161
149					
150	**PREMIUM ASSOCIATED WITH PSD's**				**4,550,700**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: SPRING STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	660	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,320**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: SPRING STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,655	SF	750	1,991,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	246,135	246,135
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: SPRING STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	400	LF	60	24,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	450	LF	60	27,000
76	Allowance for power to cross tracks to opposite platform; 4 Tracks between Platforms	1	LS	35,000	35,000
77	No allowance for new lighting as if APG's are used		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	2,000	Hrs	160	319,860
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: SPRING STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	**Training**				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	**Out of hours Work**				
112	Allow loss of production to work at night say 50%	1	LS	3,978,704	3,978,704
114	**TOTAL PSD WORK:**				**$ 17,241,050**

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	5,694	SF	750	4,270,365
127	Spare Parts - Approx. 10% of Material Cost	1	LS	454,342	454,342
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
130	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Platform Edge Repair				
133	Remove concrete platform edge	1,320	LF	27	35,640
134	Platform edge repair	1,320	LF	109	143,880
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
136	Signal Work [Each 300' length is associated with one signal light]				
137	Disconnects	80	HRS	162	12,960
138	Remove signal cables	600	LF	40	24,000
139	Remove conduit; Assuming 1”	600	LF	55	33,000
140	Install conduit in new position	600	LF	110	66,000
141	Install replacement cable; assumed single cable #12	600	LF	125	75,000
142	Re-commission / testing as required	2	EA	12,500	25,000
143	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: SPRING STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144	Premium Time	1,569	HRS	49	76,253
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,655)	SF	750	(1,991,250)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,135	(246,135)
153	Platform Edge Reconstruction work	(1)	LS	593,000	(593,000)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,160,585	1,160,585
158					
159	**PREMIUM ASSOCIATED WITH PSD's**				**5,029,201**

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: CANAL STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	653	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,313**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,313	LF	7	9,191
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,565	SF	12	78,780
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	132	CY	2,500	330,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,315	EA	25	32,875
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,315	EA	25	32,875
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,313	LF	95	124,735
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,313	LF	15	19,695
26	Remove existing platform tiles	1,313	LF	12	15,756
27	Sawcut existing topping concrete at perimeter of removal area	1,313	LF	5	6,565
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,878	SF	8	63,024
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,313	SF	15	19,695

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: CANAL STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,624	SF	750	1,967,625
61	Spare Parts - Approx. 10% of Material Cost	1	LS	244,718	244,718
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: CANAL STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,313	LF	60	78,780
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	Allowance for power to cross tracks to opposite platform	1	LS	35,000	35,000
77	No allowance for new lighting as if APG's are used		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	2,000	Hrs	160	319,860
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: CANAL STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	**Training**				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	**Out of hours Work**				
112	Allow loss of production to work at night say 50%	1	LS	3,958,870	3,958,870
114	**TOTAL PSD WORK:**				**$ 17,155,105**

116					
117	**ADD ALTERNATIVE**				
118					
119	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
120					
121	**ADD**				
122	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
124	Double egress/service gate in the center of the platform; #1 per Platform	4	EA	30,000	120,000
125	Platform End Gates (PEGs)	8	EA	18,000	144,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	5,638	SF	750	4,228,365
127	Spare Parts - Approx. 10% of Material Cost	1	LS	459,742	459,742
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	87,079
130	L6x6x1/2 continuous angle	10	TONS	17,500	169,114
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long	1	LS	350,000	350,000
133	Platform Edge Repair				
134	Remove concrete platform edge	-	LF	27	-
135	Platform edge repair	-	LF	109	-
136	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	-	EA	10	-
137	Signal Work [Each 300' length is associated with one signal light]				
138	Disconnects	240	HRS	162	38,880
139	Remove signal cables	1,800	LF	40	72,000
140	Remove conduit; Assuming 1"	1,800	LF	55	99,000
141	Install conduit in new position	1,800	LF	110	198,000
142	Install replacement cable; assumed single cable #12	1,800	LF	125	225,000
143	Re-commission / testing as required	6	EA	12,500	75,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: CANAL STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144	Engineering / Shop Drawings / Etc.	6	EA	7,500	45,000
145	Premium Time	4,706	HRS	49	228,712
146					
147	**OMIT**				
148	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
149	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
150	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
151	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
152	Fixed Panels including framing and support; 4'-6" High	(2,624)	SF	750	(1,967,625)
153	Spare Parts - Approx. 10% of Material Cost	(1)	LS	244,718	(244,718)
154	Platform Edge Reconstruction work	(1)	LS	589,730	(589,730)
155	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
156	Conduit running under Platform Edge	(1,313)	LF	30	(39,390)
157					
158	Allow loss of production to work at night say 50%	1	LS	1,442,843	1,442,843
159					
160					
161	**PREMIUM ASSOCIATED WITH PSD's**				**6,252,321**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: WORLD TRADE CENTER

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE ISLAND PLATFORM EDGE	1,320	LF		
5	TOTAL LENGTH OF THE PLATFORM EDGE =	1,320	LF		
6	NUMBER OF TRAIN CARS ON THIS LINE =	10	CARS		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	**Platform edge reconstruction**				
11	Demolition				
12	Remove existing polyethylene edge strip	1,320	LF	7	9,240
13	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
16	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
17	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
18	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
19	Polyethylene edge strip	1,320	LF	95	125,400
20	Provide sleeves for HV & LV wires	328	EA	110	36,080
21					
22	**Platform edge finishes**				
23	Demolition				
24	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
25	Remove existing platform tiles	1,320	LF	12	15,840
26	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
27	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
28	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
29	New Work				
30	New concrete topping to match existing	1,320	SF	15	19,800
31	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: WORLD TRADE CENTER

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
33	Misc. patchwork	1	LS	50,000	50,000
34					
35	**Equipment Room [6'-6" x 27'-0"]**				
36	Build off existing platform slab		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
38	CMU Wall for equipment room	605	SF	45	27,225
39	Vertical connections with existing structure	20	LF	25	500
40	Roof for equipment room	176	SF	30	5,265
41	Fire rated door including frame & hardware	1	EA	2,500	2,500
42	Exterior wall finish				
43	Ceramic Tiling to match existing	605	SF	40	24,200
44	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
45	Concrete cove to match existing	61	LF	20	1,210
46	Interior Wall Finish - Paint	605	SF	5	3,025
47	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
48	Allow for 4" thick concrete pads for equipment	44	SF	20	878
49	Allowance for Mechanical Scope	1	LS	40,000	40,000
50	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
51	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
52	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
53					
54	**Automatic Platform Gates [APGs] - 4'-6" High**				
55	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
56	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
57	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
58	Platform End Gates (PEGs)	4	EA	13,000	52,000
59	Fixed Panels including framing and support; 4'-6" High	2,655	SF	750	1,991,250
60	Spare Parts - Approx. 10% of Material Cost	1	LS	246,135	246,135
61	Testing and commissioning	800	HRS	160	127,944
62	Product Warranty	1	LS	1,000,000	1,000,000
63	Allowance for Braille Signage	80	EA	2,500	200,000
64					
65	**Electrical**				
66	Electrical Upgrades				
67	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
68	Power and Lighting				
69	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
70	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: WORLD TRADE CENTER

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
	PSD Connections	1	LS	75,000	75,000
72	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
73	Power to PSD Rooms from EDR [Conduit & Cable]	850	LF	60	51,000
74	Reserve power to PSD Room from EDR [Conduit & Cable]	900	LF	60	54,000
75	Allowance for power to cross tracks to opposite platform	1	LS	15,000	15,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	2,000	Hrs	160	319,860
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: WORLD TRADE CENTER

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,988,904	3,988,904
113	**TOTAL PSD WORK:**				**$ 17,285,250**

115					
116	**ADD ALTERNATIVE**				
117					
118	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
119					
120	**ADD**				
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,694	SF	750	4,270,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	454,342	454,342
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
129	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long	1	LS	350,000	350,000
132	Platform Edge Repair				
133	Remove concrete platform edge	-	LF	27	-
134	Platform edge repair	-	LF	109	-
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	-	EA	10	-
136	Signal Work [Each 300' length is associated with one signal light]				
137	Disconnects	80	HRS	162	12,960
138	Remove signal cables	600	LF	40	24,000
139	Remove conduit; Assuming 1"	600	LF	55	33,000
140	Install conduit in new position	600	LF	110	66,000
141	Install replacement cable; assumed single cable #12	600	LF	125	75,000
142	Re-commission / testing as required	2	EA	12,500	25,000
143	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: WORLD TRADE CENTER

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144	Premium Time	1,569	HRS	49	76,253
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,655)	SF	750	(1,991,250)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,135	(246,135)
153	Platform Edge Reconstruction work	(1)	LS	593,000	(593,000)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,209,761	1,209,761
158					
159					
160	**PREMIUM ASSOCIATED WITH PSD's**				**5,242,297**

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 7TH AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE UPPER PLATFORM EDGE [SOUTH BOUND] =	658	LF		
5	LENGTH OF THE LOWER PLATFORM EDGE [NORTH BOUND] =	658	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,315**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,315	LF	7	9,205
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,575	SF	12	78,900
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	132	CY	2,500	330,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,317	EA	25	32,925
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,317	EA	25	32,925
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,315	LF	95	124,925
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,315	LF	15	19,725
26	Remove existing platform tiles	1,315	LF	12	15,780
27	Sawcut existing topping concrete at perimeter of removal area	1,315	LF	5	6,575
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,890	SF	8	63,120
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,315	SF	15	19,725

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 7TH AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room Upper Platform Level [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,633	SF	750	1,974,375
61	Spare Parts - Approx. 10% of Material Cost	1	LS	245,123	245,123
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 7TH AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,315	LF	60	78,900
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	650	LF	60	39,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	700	LF	60	42,000
76	Allowance for power to cross tracks to opposite platform [Upper level]	1	LS	15,000	15,000
77	Allowance for power to cross tracks to opposite platform [Lower level]	1	LS	15,000	15,000
78	No allowance for new lighting as if APG's are used		Note		EXCL.
79	Grounding				
80	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
81	MISC				
82	Testing and commissioning	1	EA	30,000	30,000
83	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
84					
85	**Communications**				
86	FA System				
87	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
88	CCTV coverage				
89	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
90	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
91	Berthing Technology Sensors				
92	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
93	Train Door Detection System				
94	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
95	Entrapment concerns				
96	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
97	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
98	Engineering and Testing	2,000	Hrs	160	319,860
99	Centralized monitoring/control				
100	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 7TH AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
101	MISC				
102	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
103	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
104	Site Survey and Inspections	1	LS	100,000	100,000
105	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
106	Furnish Test Equipment allowance	1	LS	500,000	500,000
107	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
108					
109	Training				
110	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
111					
112	Out of hours Work				
113	Allow loss of production to work at night say 50%	1	LS	3,979,537	3,979,537
115	TOTAL PSD WORK:				$ 17,244,660

117					
118	ADD ALTERNATIVE				
119					
120	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
121					
122	ADD				
123	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
124	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
125	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
126	Platform End Gates (PEGs)	4	EA	18,000	72,000
127	Fixed Panels including framing and support; Assuming 8'-0" high	5,654	SF	750	4,240,365
128	Spare Parts - Approx. 10% of Material Cost	1	LS	452,542	452,542
129	Structual framing / bracing				
130	HSS4x4x1/2 hanger	5	TONS	17,500	87,210
131	L6x6x1/2 continuous angle	10	TONS	17,500	169,372
132	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
133	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long	1	LS	350,000	350,000
134	Platform Edge Repair				
135	Remove concrete platform edge	-	LF	27	-
136	Platform edge repair	-	LF	109	-
137	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	-	EA	10	-
138	Signal Work [Each 300' length is associated with one signal light]				
139	Disconnects	80	HRS	162	12,960
140	Remove signal cables	600	LF	40	24,000
141	Remove conduit; Assuming 1”	600	LF	55	33,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: 7TH AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Install conduit in new position	600	LF	110	66,000
143	Install replacement cable; assumed single cable #12	600	LF	125	75,000
144	Re-commission / testing as required	2	EA	12,500	25,000
145	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
146	Premium Time	1,569	HRS	49	76,253
147					
148	OMIT				
149	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
150	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
151	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
152	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
153	Fixed Panels including framing and support; 4'-6" High	(2,633)	SF	750	(1,974,375)
154	Spare Parts - Approx. 10% of Material Cost	(1)	LS	245,123	(245,123)
155	Platform Edge Reconstruction work	(1)	LS	589,950	(589,950)
156	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
157	Conduit running under Platform Edge	(1,315)	LF	30	(39,450)
158					
159	Allow loss of production to work at night say 50%	1	LS	1,206,256	1,206,256
160					
161					
162	**PREMIUM ASSOCIATED WITH PSD's**				**5,227,108**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: JAMAICA CTR PARSONS / ARCHER

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE UPPER ISLAND PLATFORM EDGE =	1,326	LF		
5	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,326**	**LF**		
6	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
7					
8	**AUTOMATIC PLATFORM GATES [APG's]**				
9					
10	**Platform edge reconstruction**				
11	Demolition				
12	Remove existing polyethylene edge strip	1,326	LF	7	9,282
13	Remove 5' wide section of 3" deep structural slab to platform edge	6,630	SF	12	79,560
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	134	CY	2,500	335,000
16	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,328	EA	25	33,200
17	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,328	EA	25	33,200
18	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
19	Polyethylene edge strip	1,326	LF	95	125,970
20	Provide sleeves for HV & LV wires	328	EA	110	36,080
21					
22	**Platform edge finishes**				
23	Demolition				
24	Remove existing tactile warning strip 2' wide	1,326	LF	15	19,890
25	Remove existing platform tiles	1,326	LF	12	15,912
26	Sawcut existing topping concrete at perimeter of removal area	1,326	LF	5	6,630
27	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,956	SF	8	63,648
28	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
29	New Work				
30	New concrete topping to match existing	1,326	SF	15	19,890
31	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: JAMAICA CTR PARSONS / ARCHER

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
33	Misc. patchwork	1	LS	50,000	50,000
34					
35	**Equipment Room Upper Platform Level [6'-6" x 27'-0"]**				
36	Build off existing platform slab		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
38	CMU Wall for equipment room	605	SF	45	27,225
39	Vertical connections with existing structure	20	LF	25	500
40	Roof for equipment room	176	SF	30	5,265
41	Fire rated door including frame & hardware	1	EA	2,500	2,500
42	Exterior wall finish				
43	Ceramic Tiling to match existing	605	SF	40	24,200
44	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
45	Concrete cove to match existing	61	LF	20	1,210
46	Interior Wall Finish - Paint	605	SF	5	3,025
47	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
48	Allow for 4" thick concrete pads for equipment	44	SF	20	878
49	Allowance for Mechanical Scope	1	LS	40,000	40,000
50	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
51	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
52	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
53					
54	**Automatic Platform Gates [APGs] - 4'-6" High**				
55	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
56	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
57	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
58	Platform End Gates (PEGs)	4	EA	13,000	52,000
59	Fixed Panels including framing and support; 4'-6" High	2,682	SF	750	2,011,500
60	Spare Parts - Approx. 10% of Material Cost	1	LS	247,350	247,350
61	Testing and commissioning	800	HRS	160	127,944
62	Product Warranty	1	LS	1,000,000	1,000,000
63	Allowance for Braille Signage	80	EA	2,500	200,000
64					
65	**Electrical**				
66	Electrical Upgrades				
67	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
68	Power and Lighting				
69	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
70	Allow for conduit / cable runs for power and communications under platform edge	1,326	LF	60	79,560

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: JAMAICA CTR PARSONS / ARCHER

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
	PSD Connections	1	LS	75,000	75,000
72	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
73	Power to PSD Rooms from EDR [Conduit & Cable]	800	LF	60	48,000
74	Reserve power to PSD Room from EDR [Conduit & Cable]	850	LF	60	51,000
75	Allowance for power to cross tracks to opposite platform [Upper Level]; 4 Tracks between Platforms	1	LS	35,000	35,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	2,000	Hrs	160	319,860
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: JAMAICA CTR PARSONS / ARCHER

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	4,000,954	4,000,954
113	**TOTAL PSD WORK:**				**$ 17,337,467**

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
115					
116	**ADD ALTERNATIVE**				
117					
118	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
119					
120	**ADD**				
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,742	SF	750	4,306,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	456,502	456,502
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	87,928
129	L6x6x1/2 continuous angle	10	TONS	17,500	170,789
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long	1	LS	350,000	350,000
132	Platform Edge Repair				
133	Remove concrete platform edge	1,326	LF	27	35,802
134	Platform edge repair	1,326	LF	109	144,534
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
136					
137	**OMIT**				
138	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
139	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
140	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
141	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: JAMAICA CTR PARSONS / ARCHER

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
142	Fixed Panels including framing and support; 4'-6" High	(2,682)	SF	750	(2,011,500)
143	Spare Parts - Approx. 10% of Material Cost	(1)	LS	247,350	(247,350)
144	Platform Edge Reconstruction work	(1)	LS	596,160	(596,160)
145	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
146	Conduit running under Platform Edge	(1,326)	LF	30	(39,780)
147					
148	Allow loss of production to work at night say 50%	1	LS	1,172,021	1,172,021
149					
150					
151	**PREMIUM ASSOCIATED WITH PSD's**				**5,078,760**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: SUTPHIN BLVD ARCHER AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE UPPER ISLAND PLATFORM EDGE =	1,230	LF		
5	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,230**	**LF**		
6	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
7					
8	**AUTOMATIC PLATFORM GATES [APG's]**				
9					
10	**Platform edge reconstruction**				
11	Demolition				
12	Remove existing polyethylene edge strip	1,230	LF	7	8,610
13	Remove 5' wide section of 3" deep structural slab to platform edge	6,150	SF	12	73,800
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
16	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,232	EA	25	30,800
17	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,232	EA	25	30,800
18	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
19	Polyethylene edge strip	1,230	LF	95	116,850
20	Provide sleeves for HV & LV wires	328	EA	110	36,080
21					
22	**Platform edge finishes**				
23	Demolition				
24	Remove existing tactile warning strip 2' wide	1,230	LF	15	18,450
25	Remove existing platform tiles	1,230	LF	12	14,760
26	Sawcut existing topping concrete at perimeter of removal area	1,230	LF	5	6,150
27	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,380	SF	8	59,040
28	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
29	New Work				
30	New concrete topping to match existing	1,230	SF	15	18,450
31	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: SUTPHIN BLVD ARCHER AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
33	Misc. patchwork	1	LS	50,000	50,000
34					
35	**Equipment Room [6'-6" x 27'-0"]**				
36	Build off existing platform slab		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
38	CMU Wall for equipment room	605	SF	45	27,225
39	Vertical connections with existing structure	20	LF	25	500
40	Roof for equipment room	176	SF	30	5,265
41	Fire rated door including frame & hardware	1	EA	2,500	2,500
42	Exterior wall finish				
43	Ceramic Tiling to match existing	605	SF	40	24,200
44	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
45	Concrete cove to match existing	61	LF	20	1,210
46	Interior Wall Finish - Paint	605	SF	5	3,025
47	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
48	Allow for 4" thick concrete pads for equipment	44	SF	20	878
49	Allowance for Mechanical Scope	1	LS	40,000	40,000
50	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
51	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
52	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
53					
54	**Automatic Platform Gates [APGs] - 4'-6" High**				
55	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
56	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
57	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
58	Platform End Gates (PEGs)	4	EA	13,000	52,000
59	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
60	Spare Parts - Approx. 10% of Material Cost	1	LS	227,910	227,910
61	Testing and commissioning	800	HRS	160	127,944
62	Product Warranty	1	LS	1,000,000	1,000,000
63	Allowance for Braille Signage	80	EA	2,500	200,000
64					
65	**Electrical**				
66	Electrical Upgrades				
67	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
68	Power and Lighting				
69	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
70	Allow for conduit / cable runs for power and communications under platform edge	1,230	LF	60	73,800

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: SUTPHIN BLVD ARCHER AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
	PSD Connections	1	LS	75,000	75,000
72	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
73	Power to PSD Room from EDR [Conduit & Cable]	850	LF	60	51,000
74	Reserve power to PSD Room from EDR [Conduit & Cable]	900	LF	60	54,000
75	Allowance for power to cross tracks to opposite platform [Upper level]	1	LS	15,000	15,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	2,000	Hrs	160	319,860
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: SUTPHIN BLVD ARCHER AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,875,652	3,875,652
113	TOTAL PSD WORK:				$ 16,794,493

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,974	SF	750	3,730,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	421,942	421,942
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,657
129	L6x6x1/2 continuous angle	9	TONS	17,500	158,424
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long	1	LS	350,000	350,000
132	Platform Edge Repair				
133	Remove concrete platform edge	1,230	LF	27	33,210
134	Platform edge repair	1,230	LF	109	134,070
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
136					
137	OMIT				
138	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
139	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
140	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
141	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: SUTPHIN BLVD ARCHER AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
142	Fixed Panels including framing and support; 4'-6" High	(2,250)	SF	750	(1,687,500)
143	Spare Parts - Approx. 10% of Material Cost	(1)	LS	227,910	(227,910)
144	Platform Edge Reconstruction work	(1)	LS	560,600	(560,600)
145	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
146	Conduit running under Platform Edge	(1,230)	LF	30	(36,900)
147					
148	Allow loss of production to work at night say 50%	1	LS	1,093,910	1,093,910
149					
150					
151	**PREMIUM ASSOCIATED WITH PSD's**				**4,740,276**

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: JAMAICA VAN WYCK

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE	1,230	LF		
5	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,230**	**LF**		
6	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
7					
8	**AUTOMATIC PLATFORM GATES [APG's]**				
9					
10	**Platform edge reconstruction**				
11	Demolition				
12	Remove existing polyethylene edge strip	1,230	LF	7	8,610
13	Remove 5' wide section of 3" deep structural slab to platform edge	6,150	SF	12	73,800
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
16	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,232	EA	25	30,800
17	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,232	EA	25	30,800
18	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
19	Polyethylene edge strip	1,230	LF	95	116,850
20	Provide sleeves for HV & LV wires	328	EA	110	36,080
21					
22	**Platform edge finishes**				
23	Demolition				
24	Remove existing tactile warning strip 2' wide	1,230	LF	15	18,450
25	Remove existing platform tiles	1,230	LF	12	14,760
26	Sawcut existing topping concrete at perimeter of removal area	1,230	LF	5	6,150
27	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,380	SF	8	59,040
28	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
29	New Work				
30	New concrete topping to match existing	1,230	SF	15	18,450
31	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: JAMAICA VAN WYCK

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
33	Misc. patchwork	1	LS	50,000	50,000
34					
35	**Equipment Room [6'-6" x 27'-0"]**				
36	Build off existing platform slab		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
38	CMU Wall for equipment room	605	SF	45	27,225
39	Vertical connections with existing structure	20	LF	25	500
40	Roof for equipment room	176	SF	30	5,265
41	Fire rated door including frame & hardware	1	EA	2,500	2,500
42	Exterior wall finish				
43	Ceramic Tiling to match existing	605	SF	40	24,200
44	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
45	Concrete cove to match existing	61	LF	20	1,210
46	Interior Wall Finish - Paint	605	SF	5	3,025
47	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
48	Allow for 4" thick concrete pads for equipment	44	SF	20	878
49	Allowance for Mechanical Scope	1	LS	40,000	40,000
50	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
51	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
52	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
53					
54	**Automatic Platform Gates [APGs] - 4'-6" High**				
55	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
56	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
57	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
58	Platform End Gates (PEGs)	4	EA	13,000	52,000
59	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
60	Spare Parts - Approx. 10% of Material Cost	1	LS	227,910	227,910
61	Testing and commissioning	800	HRS	160	127,944
62	Product Warranty	1	LS	1,000,000	1,000,000
63	Allowance for Braille Signage	80	EA	2,500	200,000
64					
65	**Electrical**				
66	Electrical Upgrades				
67	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
68	Power and Lighting				
69	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
70	Allow for conduit / cable runs for power and communications under platform edge	1,230	LF	60	73,800

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: JAMAICA VAN WYCK

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
	PSD Connections	1	LS	75,000	75,000
72	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
73	Power to PSD Rooms from EDR [Conduit & Cable]	200	LF	60	12,000
74	Reserve power to PSD Room from EDR [Conduit & Cable]	250	LF	60	15,000
75	Allowance for power to cross tracks to opposite platform	1	LS	15,000	15,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	2,000	Hrs	160	319,860
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: JAMAICA VAN WYCK

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,852,252	3,852,252
113	**TOTAL PSD WORK:**				**$ 16,693,093**

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,974	SF	750	3,730,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	421,942	421,942
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,657
129	L6x6x1/2 continuous angle	9	TONS	17,500	158,424
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long	1	LS	350,000	350,000
132	Platform Edge Repair				
133	Remove concrete platform edge	1,230	LF	27	33,210
134	Platform edge repair	1,230	LF	109	134,070
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
136					
137	OMIT				
138	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
139	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
140	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
141	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for E-Line Stations

27-Sep-18

STATION: JAMAICA VAN WYCK

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
142	Fixed Panels including framing and support; 4'-6" High	(2,250)	SF	750	(1,687,500)
143	Spare Parts - Approx. 10% of Material Cost	(1)	LS	227,910	(227,910)
144	Platform Edge Reconstruction work	(1)	LS	560,600	(560,600)
145	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
146	Conduit running under Platform Edge	(1,230)	LF	30	(36,900)
147					
148	Allow loss of production to work at night say 50%	1	LS	1,093,910	1,093,910
149					
150					
151	**PREMIUM ASSOCIATED WITH PSD's**				**4,740,276**

New York City Transit

S 1 2 3
4 5 6 7
A C E L
B D F M
N R Q W
G J Z

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR 'F' LINE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

SUBMITTAL DATE: December 19, 2018

STV 100 Years

Table of Contents

Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 45 newly evaluated stations, 40 have been found to be not suitable for the installation of PSDs.

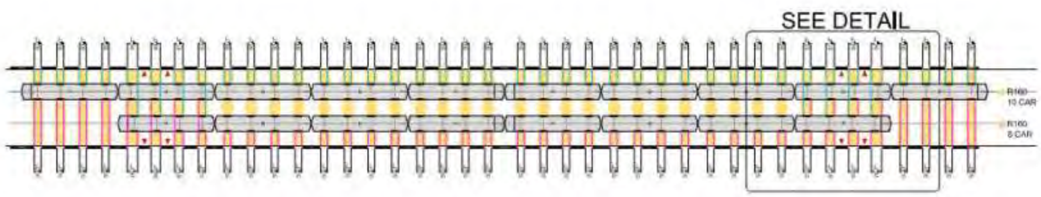
[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to low-height barriers]

The following points summarize the major constraints to installing a PSD system:

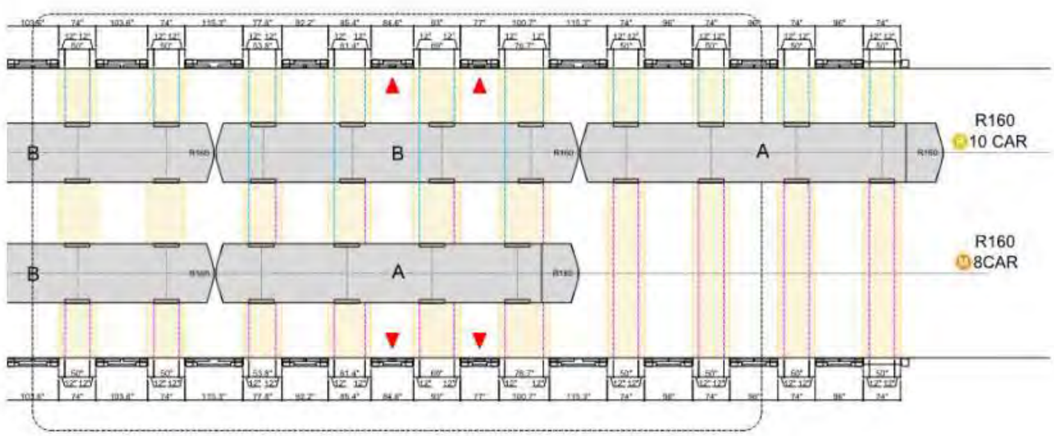
- ADA clearance issues; the platform edge barriers are 15" wide. Where an existing object (wall, stair, railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Where these PSDs hamper the ability of a wheelchair to turn (a 5'-0" circle) and/or limit path of travel to less than 32" pinch width, it is declared infeasible. This requirement dictates that if a column or any obstruction measuring less than or equal to 24" in the direction of circulation is present, it may not constrain the circulation path to less than 32".
- Insufficient space for the PSD equipment room; the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow; due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements in regard to the placement of these new barriers in an existing station environment.
- Structural considerations; existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit. There are structural anomalies affecting the ability of platform edges to support PSD loads occurring at the three stations on the 63rd Street line as well as at three stations on the 6th Avenue line. These stations required a further structural analysis that can be found in the station specific reports.

- Car door misalignment (part of Tier 1 selection process): Presently (2018) the NYCT system features three car geometries on the A Division and three car geometries on the B Division. With few exceptions, these cars are freely mixed between lines. The spacing of doors on these differing cars is significantly misaligned, making the installation of platform doors infeasible. Looking to the future, NYCT plans to procure new rolling stock with identical or nearly identical door spacing. The current procurement schedule indicates the purchase of these geometrically compatible cars by 2032. Therefore, our assessment of feasibility is based on the year 2032.

  However, the F-line service and an overlapping service on the B Division will remain incompatible even after 2032. The F is a ten-car train, whereas the M line is an eight-car train. The newer trains are assembled in two consists, with a driver / conductor cabin at the front and back of each consist. Due to the cabin, the spacing of doors on the first and last car differs from the door spacing of the other cars of the train. Therefore, there will inevitably be a mismatching of doors as these two differing train types berth at a certain station platform. The M train cannot be extended to a ten-car length because all the station stops in Brooklyn feature station platforms of an eight-car length. Therefore, 17 of the 45 stations on the F-line are infeasible due to this incompatibility. Please see the diagrams in Figure 1 below.



Overall view of 10-car train versus 8-car train



Detail view of "A" car (with driver cabin) and "B" car. Sliding PSD doors cannot cover the wide openings required to cover both train door locations at the first two doors. A similar misalignment occurs at the rear of the train.

LEGEND
▲ SPACE BETWEEN DOOR OPENINGS IS INSUFFICIENT IN LENGTH TO ACCOMODATE SLIDING DOORS.

***Figure 1** – Ten-car vs. eight-car train*
Comparison of door geometry

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the wall and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

Please note: Electrical capacity is not considered as a factor affecting feasibility in the installation of a future APG or PSD system in this study. Inadequate electrical capacity is observed as a factor that will increase the cost of installing a future APG or PSD system.

A garbage train is used for refuse removal on the 'F' Line. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the (off) loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in damage from these carts along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process.

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 11% of the 'F' Line stations. Total implementation cost would be $159.2M for APGs and $202.1M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; That estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of $931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 5 feasible stations, the aggregate annual maintenance cost would be $4,655,000.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'F' Line Stations

'F' Line Summary of Feasibility (11% feasible; 5/45)

No.	Station Name	Station Type	Platform Type	Feasible Yes / No	Issues / Reason for Failure	Cost APGs	Cost PSDs
MR-254	Jamaica- 179th Street	Below-grade	Center/Island	No	ADA clearance		
MR-255	169th Street	Below-grade	Side	No	ADA clearance		
MR-256	Parsons Boulevard	Below-grade	Side	No	ADA clearance		
MR-257	Sutphin Boulevard	Below-grade	Side	No	ADA clearance		
MR-258	Briarwood	Below-grade	Side	No	ADA clearance		
MR-259	Kew Gardens-Union Turnpike	Below-grade	Center/Island	No	ADA clearance		
MR-260	75th Avenue	Below-grade	Side	No	ADA clearance		
MR-261	Forest Hill- 71st Avenue	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment		
MR-267	Roosevelt Ave- Jackson Heights	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment		
MR-221	21st Street- Queensbridge	Below-grade	Center/Island	Yes		$31.4M	$39.8M
MR-222	Roosevelt Island	Below-grade	Side	Yes		$31.5M	$40.8M
MR-223	Lexington Ave-63rd Street	Below-grade	Center/Island	Yes		$31.6M	$39.3M
MR-224	57th Street	Below-grade	Center/Island	No	ADA clearance		
MR-225	47-50 Streets- Rockefeller Center	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment		
MR-226	42nd Street- Bryant Park	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment		
MR-227	34th Street-Herald Square	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment		
MR-228	23rd Street	Below-grade	Side	No	Tier 1 Failure- train door misalignment		
MR-229	14th Street	Below-grade	Side	No	Tier 1 Failure- train door misalignment		
MR-230	West 4th Street	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment		
MR-231	Broadway-Lafayette Street-Bleecker Street	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment		
MR-232	2nd Avenue	Below-grade	Center/Island	No	ADA clearance		
MR-233	Delancey Street	Below-grade	Side	No	ADA clearance		
MR-234	East Broadway	Below-grade	Center/Island	No	ADA clearance		
`MR-235	York Street	Below-grade	Center/Island	Yes		$32.5M	$41.2M
MR-174	Jay Street-Metro Tech	Below-grade	Center/Island	No	ADA clearance		
MR-236	Bergen Street	Below-grade	Side	No	Tier 1 Failure- train door misalignment		
MR-237	Carroll Street	Below-grade	Side	No	Tier 1 Failure- train door misalignment		
MR-238	Smith-9th Streets	Elevated	Side	No	Tier 1 Failure- train door misalignment		
MR-239	4th Avenue	Elevated	Side	No	Tier 1 Failure- train door misalignment & ADA clearance		
MR-240	7th Avenue	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment		
MR-241	15th Street-Prospect Park	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment & ADA clearance		
MR-242	Fort Hamilton Parkway	Below-grade	Side	No	Tier 1 Failure- train door misalignment & Equipment room		
MR-243	Church Avenue	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment & ADA clearance		
MR-244	Ditmas Avenue	Elevated	Side	No	Precast platform (Appendix B)*		
MR-245	18th Avenue	Elevated	Center/Island	No	Precast platform (Appendix B)*		
MR-246	Avenue I	Elevated	Side	No	Precast platform (Appendix B)*		
MR-247	Bay Parkway	Elevated	Center/Island	No	Precast platform (Appendix B)		
MR-248	Avenue N	Elevated	Side	No	Precast platform (Appendix B)*		
MR-249	Avenue P	Elevated	Side	No	Precast platform (Appendix B)*		
MR-250	Kings Highway	Elevated	Center/Island	No	Precast platform (Appendix B)		
MR-251	Avenue U	Elevated	Side	No	Precast platform (Appendix B)		
MR-252	Avenue X	Elevated	Side	No	Precast platform (Appendix B)*		
MR-253	Neptune Ave	Elevated	Center/Island	No	Precast platform (Appendix B)*		
MR-057	West 8th Street- New York Aquarium	Elevated	Side	No	ADA clearance		
MR-058	Stillwell Ave- Coney Island	Elevated	Center/Island	Yes		$32.2M	$41.0M
					Total Estimated Cost	**$159.2M**	**$202.1M**

1.0 Station Assessments

1.1 MR-254 | Jamaica-179th Street Station

Summary: *Jamaica-179th Street Station (MR-254) is not feasible for both APGs and PSDs. This station is not feasible because the implementation of a platform edge barrier would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" width requirement for ADA compliant wheelchair movement would not be met at all stairs. Remaining widths would be approximately 25" (see figure 1).*

Description

Jamaica-179th Street Station is a below-grade terminus station serving the E and F trains. The station has two straight center/island platforms that are slightly tapered at the south-end of the station. Both platforms have one track dedicated to F-train service. The cast-in-place concrete platforms are accessed via the mezzanine. There are five stairs on the northbound platform & six stairs on the southbound platform. The platforms are approximately 19'-6" wide, but taper to a narrow 7'-0" at the south-end of the platform. Column spacing along the length of the platform is approximately 15' on center and column faces are typically 3'-4" to the edge of the platform. Currently, at all stairs along the length of the platform, a wheel chair can move between the columns and the platform edge (3'-4"). The implementation of a platform edge barrier would result in non-compliant ADA conditions that would not permit wheelchair movement along the length of the platform.

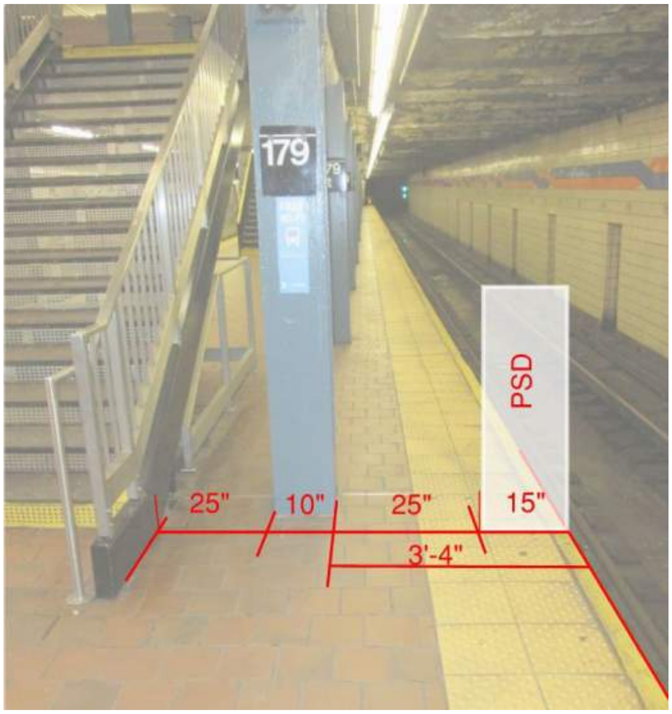


Figure 1 – Non-compliant ADA condition at stairs (typical)- Jamaica-179th Street Station

1.2 MR-255 | 169th Street Station

Summary: *169th Street Station (MR-255) is not feasible for both APGs and PSDs as their implementation would create non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" width requirement for ADA compliant wheelchair movement would not be met at all stairs. Remaining widths would be approximately 25" (see figure 1).*

Description

169th Street Station is a below-grade station with two straight side platforms. The platform structure is cast-in-place concrete. The width of the side platforms are approximately 11'-4". Columns are spaced 15' on center and columns faces are 3'-4" from the edge of the platform. There is typically 2'-0" between the column and railing at all staircases. There are five staircases along each platform, all of which would not comply with the 32" width requirement for wheelchair movement. Columns divide the path between the stairs and the platform edge. Passengers requiring an ADA-compliant path of travel can currently move along the platform in the 3'-4" between columns and the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 25" would not allow for ADA compliant wheelchair movement.

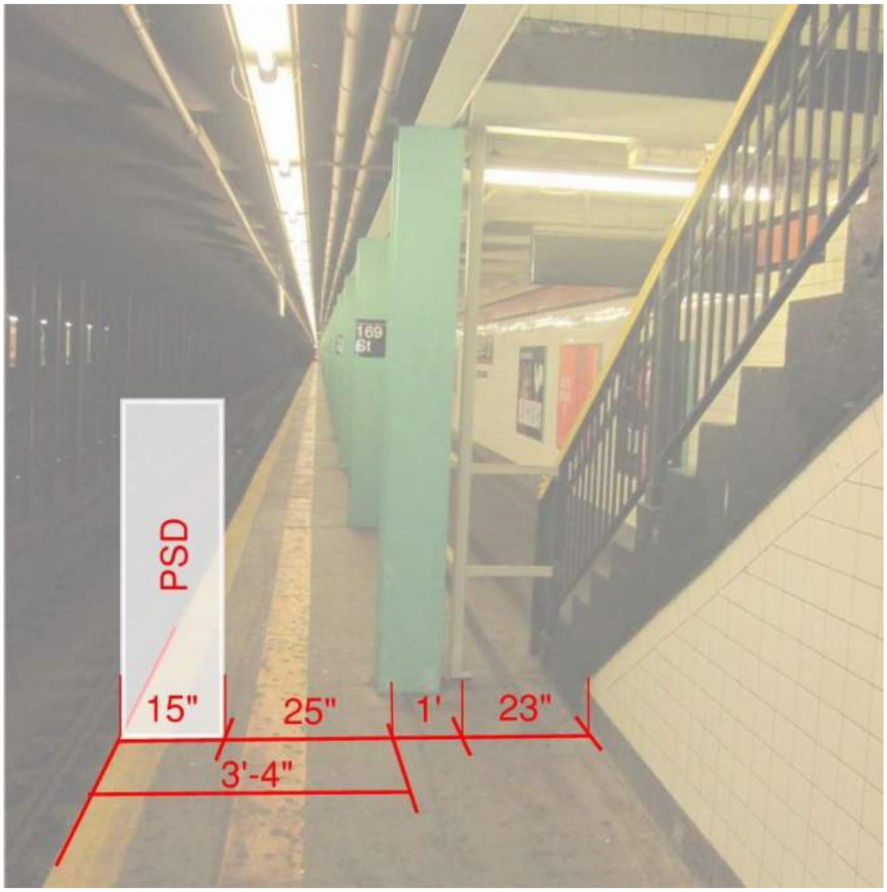


Figure 1 – Non-compliant ADA condition at stairs (typical)- 169th Street Station

1.3 MR-256 | Parsons Boulevard Station

__Summary:__ Parsons Boulevard Station (MR-256) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1). This condition occurs at all stairs on the local track edge of both platforms.

Description

Parsons Boulevard Station is a below-grade station with two straight center/island platforms. The platform structure is cast-in-place concrete. The width of both platforms is approximately 19'-6". There are five staircases along each platform, all of which would not allow for the 32" width required for wheelchair movement with PSDs installed. Columns are spaced 15' on center with column faces 3'-4" away from all platform edges. The stairs are not centered on the platform, but shifted towards the local track edges. These stair are flanked on one side by the typical station column (3'-4" from the platform edge). Typically, the stairs are 9' from the express platform edge. See figure 2 for typical edge conditions at local and express sides of the platform. Passengers requiring an ADA-compliant path of travel can currently move along the platform in the 3'-4" between columns and the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 25" would not allow for ADA compliant wheelchair movement.

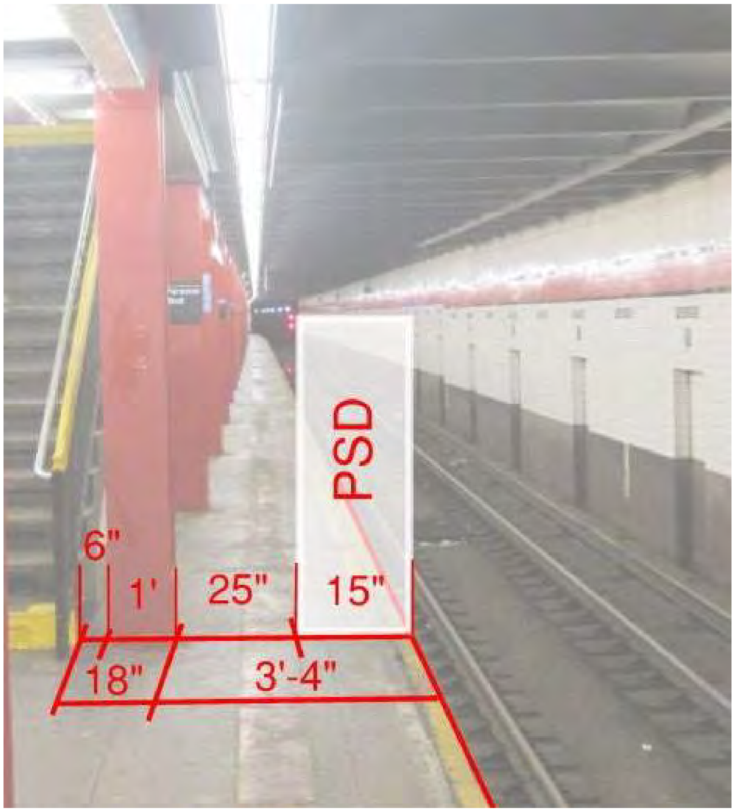


Figure 1 – Non-compliant ADA condition at stair (typical on local edge only) – Parsons Blvd. Station

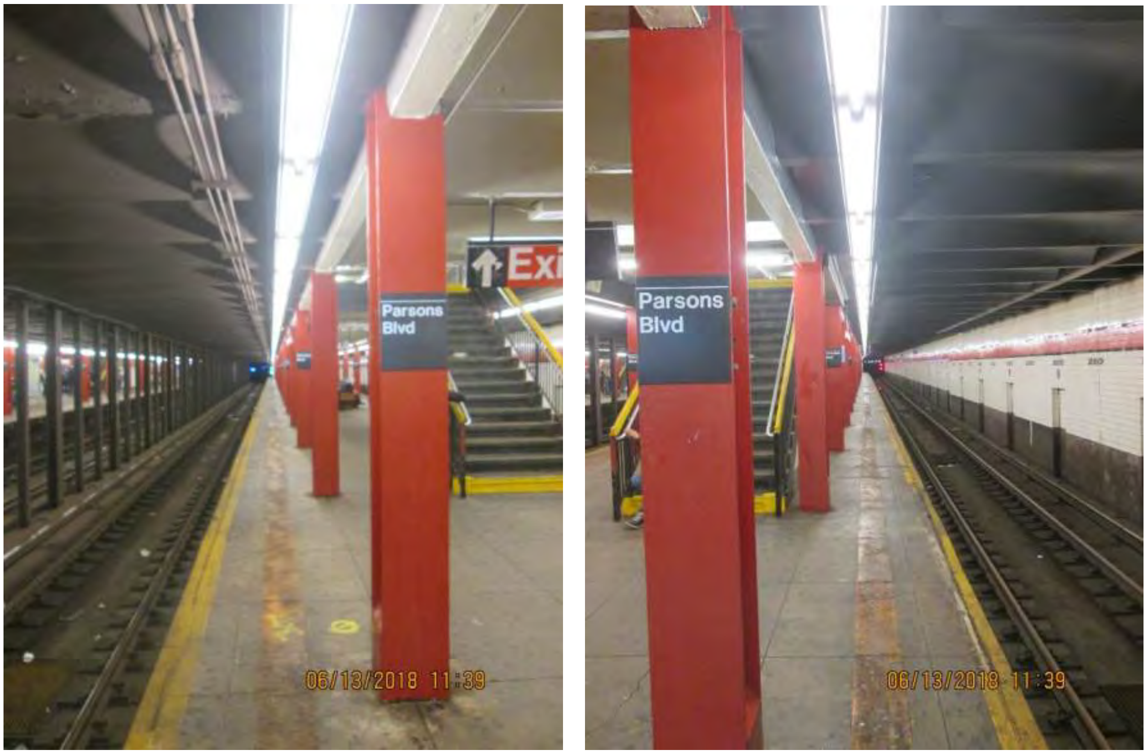


Figure 2 – Typical edge conditions | Express condition (left) and local condition (right)– Parsons Blvd. Station

1.4 MR-257 | Sutphin Boulevard Station

Summary: *Sutphin Boulevard Station (MR-257) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1). This condition would occur at all stairs on both platforms.*

Description

Sutphin Boulevard Station is a below-grade station with two straight side platforms. The platform structure is cast-in-place concrete. The width of both platforms is approximately 11'-4". There are six staircases along each platform, all of which would not allow for the 32" width required for wheelchair movement with PSDs installed. Columns divide the path between the stairs and the platform edge. Column spacing along the length of the platform is approximately 15' on center and column faces are typically 3'-4" to the edge of the platform. Currently, there is an ADA-compliant path of travel between columns and the platform edge (3'-4"). The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 25" would not allow for ADA compliant wheelchair movement.

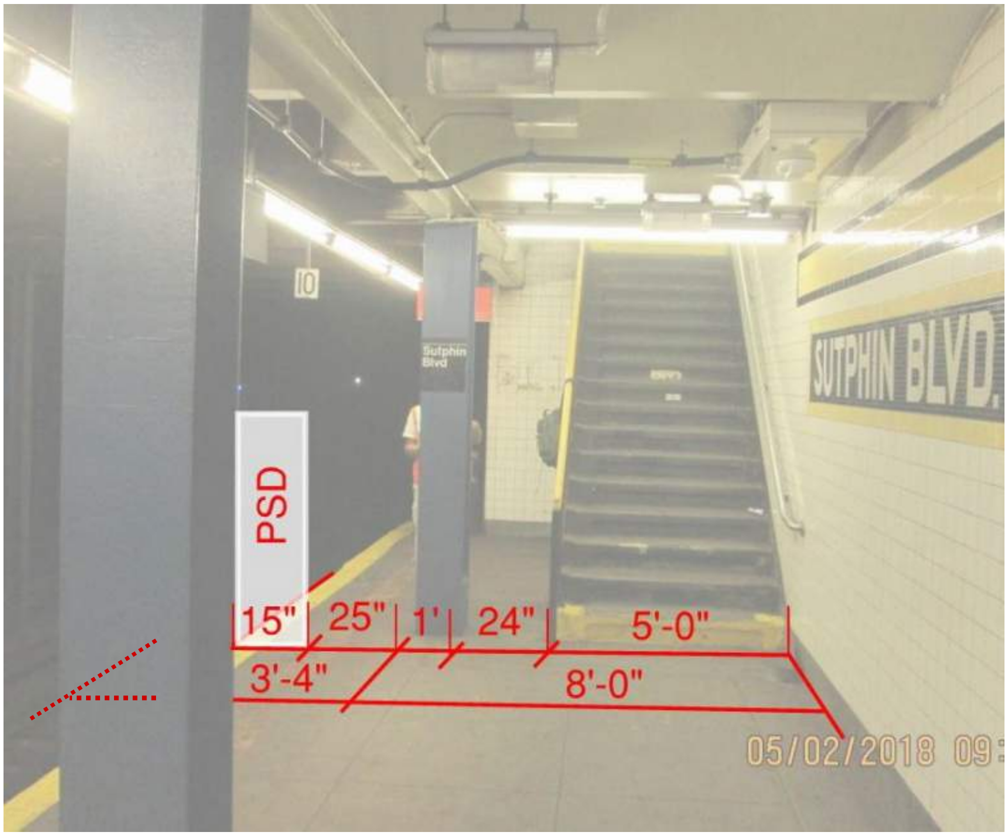


Figure 1 – Non-compliant ADA condition at stairs (typical)- Sutphin Blvd. Station

1.5 MR-258 | Briarwood Station

Summary: *Briarwood Station (MR-258) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 23" (see figure 1). This condition occurs at all stairs on both platforms.*

Description

Briarwood Station is a below-grade station with two straight side platforms. The platform structure is cast-in-place concrete. The width of both platforms is approximately 11'-4". There are four staircases along each platform, all of which would not allow for the 32" width required for wheelchair movement with PSDs installed. Columns divide the path between the stairs and the platform edge. Column spacing along the length of the platform is approximately 15'-0" on center and column faces are typically 3'-2" to the edge of the platform. Currently, there is an ADA-compliant path of travel between columns and the platform edge (3'-2"). The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 23" would not allow for ADA compliant wheelchair movement.

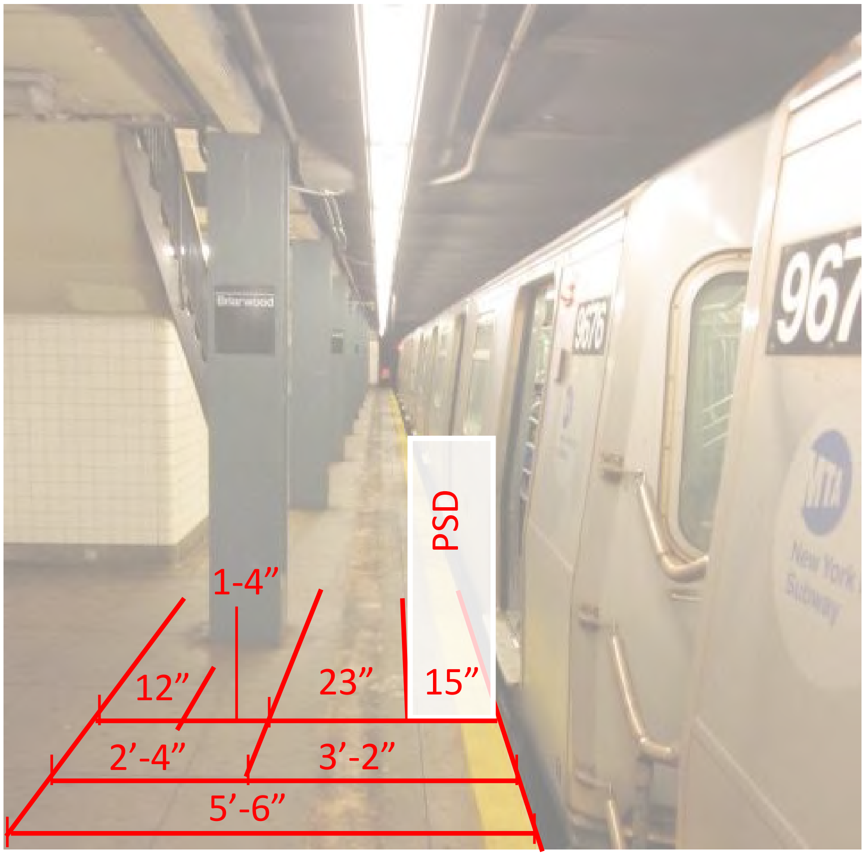


Figure 1 – Non-compliant ADA condition at stairs (typical)- Briarwood Station

1.6 MR-259 | Kew Gardens-Union Turnpike Station

Summary: *Kew Gardens-Union Turnpike Station (MR-259) is not feasible for both APGs and PSDs. The implementation of a platform edge barrier would result in non-compliant ADA conditions that would not allow for wheelchair movement along the length of the platform. At all stairs, the 32" minimum requirement for wheel chair circulation would not be met on one side of the platform (see figure 1). The remaining width would be 24".*

Description

Kew Gardens-Union Turnpike Station is a below-grade station consisting of two mildly curved center/island platforms. The cast-in-place concrete platforms are accessed via two mezzanines. There are six stairs and an elevator located on each platform. The platform is approximately 19'-0" wide. Column spacing along the length of the platform is approximately 15' on center and column faces are typically 3'-3" to the edge of the platform. Currently, at all stairs along the length of the platform, a wheel chair can move between the columns and the platform edge (3'-3"). All of the stairs are off center as shown in figure 1. Although there is adequate clear space on one side of the platform, the implementation of a platform edge barrier would not allow for ADA compliant wheelchair movement at the other side. Similarly, the elevators are shifted towards one side of the platform not allowing for 32" clearance (at one platform edge) for ADA compliant wheelchair movement. Both platform edges need to comply in order for the station to be ADA compliant for the implementation of a platform edge barrier.

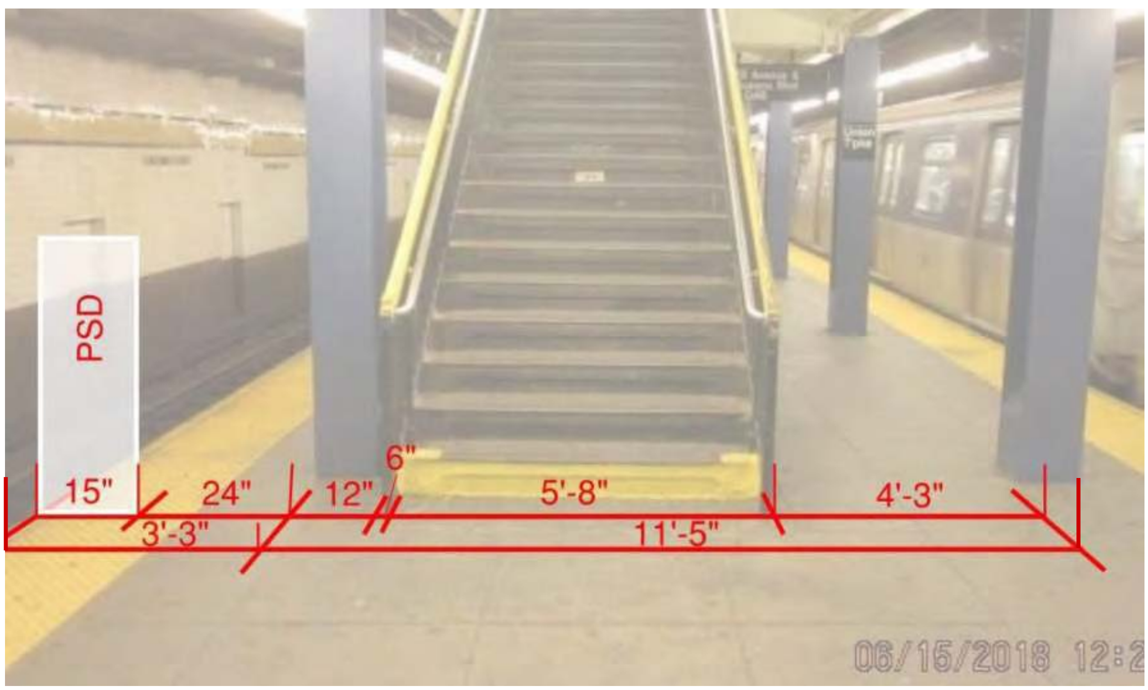


Figure 1 – Non-compliant condition on one side of the center/island platform- Kew Gardens-Union Turnpike

1.7 MR-260 | 75th Avenue Station

Summary: *75th Avenue Station (MR-260) is not feasible for both APGs and PSDs. The implementation of a platform edge barrier would result in non-compliant ADA conditions that would not allow for ADA compliant wheelchair movement along the length of the platform. At all stairs, the 32" minimum requirement for wheel chair circulation would not be met (see figure 1).*

Description

75th Avenue Station is a below-grade station consisting of two straight side platforms. The cast-in-place concrete platforms are accessed via a large mezzanine level. There are four stairs located in various locations along the length of each platform. The platforms are approximately 11'-4" wide. Column spacing along the length of the platform is approximately 15' on center and column faces are typically 3'-4" to the edge of the platform. Columns are 1'-10" away from stairs (not an ADA compliant path). Currently, at all stairs along the length of the platform, a wheel chair can move between the columns and the platform edge (3'-4"). In the implementation of a platform edge barrier, this clearance would be 25".

Figure 1 – Non-compliant condition at stairs (typical) - 75th Avenue

1.8 MR-221 | 21st Street- Queensbridge Station

Summary: *21st Street-Queensbridge Station (MR-221) is feasible for both APGs and PSDs. There are two signal boxes that would have to be relocated in the implementation of a platform edge barrier. Structural work would only be required in the implementation of APGs (see structural report; Appendix B) Electrical capacity at this station is adequate to support a APG/PSD system.*

Description

21st Street-Queensbridge Station is a below-grade station with two straight side platforms (see figure 1). The platform structure is cast-in-place concrete. Back-of-house elements are located at the mezzanine level and at the platform level away from passenger areas. The platforms are mostly column free. On both platforms, there are five 2' wide cylindrical columns which are 7'-6" away from the platform edge. Typically, the platform widths are approximately 11'-2". These columns are in a double height space that is open to the mezzanine level. On each platform, one train signal box hangs over the platform edge, with a vertical clearance of 7'-4". Ceiling heights vary throughout the station, ranging from 9'-2" to 20'-0".

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. The ceiling heights vary throughout the station (see figure 4). Train signal boxes on would need to be relocated in the implementation of full height PSDs (see figure 3).

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located on the Coney Island-bound platform adjacent to the elevators. The proposed room dimension is 7'-0" x 27'-0" (see figure 2).

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edge consists of a cast-in-place concrete cantilever that is approximately 1'-2" long and is approximately 5" thick. The platform also includes a 3" allowance for a floor finish, which was conservatively assumed to be a concrete topping slab for the purpose of assessing dead loads. The cantilever portion is reinforced with #4 rebar at 12" O.C. at the top of the slab. The station was designed in 1975, therefore it was assumed that the reinforcing rods have a yield strength of 40,000 psi (Grade 40) in the absence of additional information (Grade 60 rebar was in existence at the time, but not standard as it is today). The concrete has a compressive strength of 3000 psi, per the notes on the record drawings.

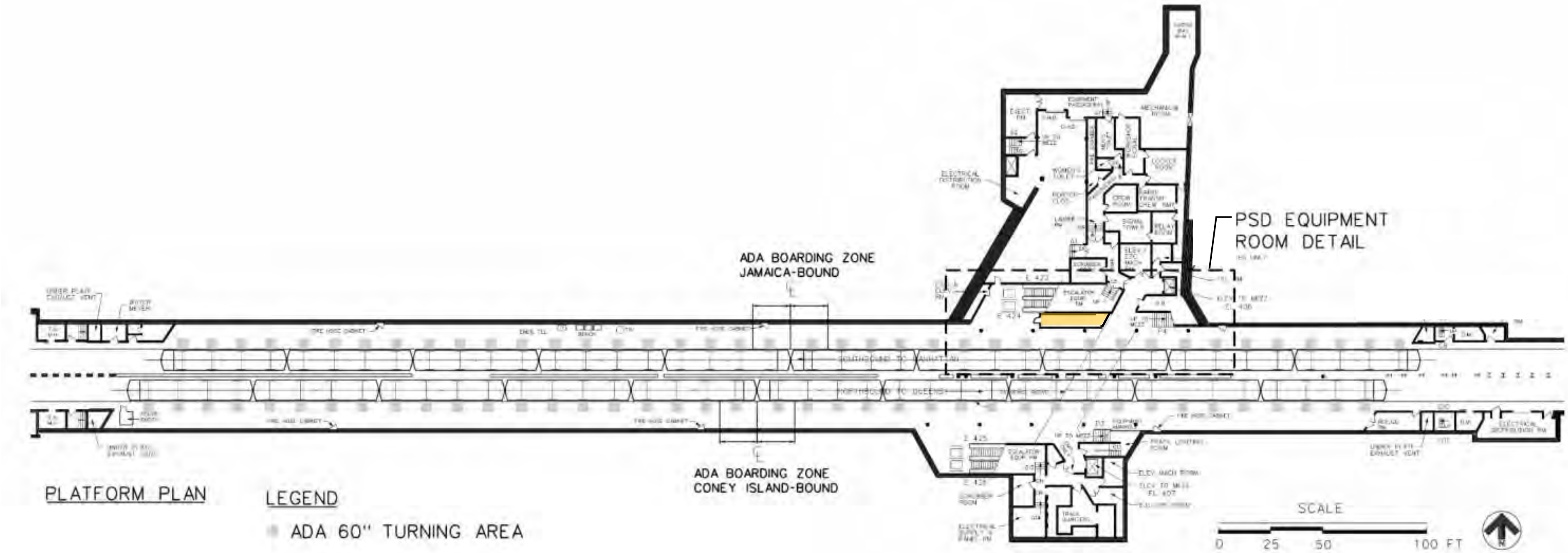


Figure 1 – Station Plan- 21st Street- Queensbridge Station

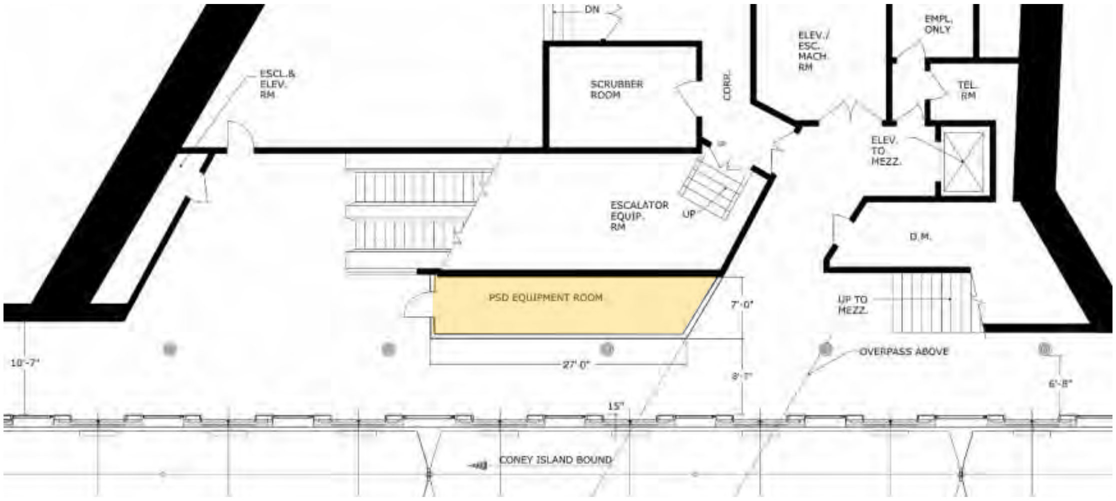


Figure 2 – PSD Equipment Room Detail – 21st Street- Queensbridge Station

Based upon the record drawings and the above assumptions, it was found that the cantilever edge has sufficient capacity to support a full height PSD system in its current condition. It cannot, however, support half height cantilevered APGs without rebuilding the platform edge to achieve a higher strength. This difference is due to the fact the APG system is fully supported at the cantilever edge and results in transfer of moment to the slab edge caused by crowd thrust and wind loading (piston effect), in addition to the weight of the system itself. The PSD system results in a moment on the slab edge due to its weight only. In both cases, self-weight of the slab edge and live load on the platform have been accounted for. The wind load and crowd thrust also result in direct tension on the slab edge, for which the slab has sufficient capacity in either case.

The 2012 NYCT conditions survey gave the platform edges an average rating of 2.5. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

Platform obstructions within 5' of edge:

None

Lighting:

Existing lighting: Along the majority of the platform, linear florescent lighting is perpendicular to the platform edge and located between structural members. In the double height area, there are recessed florescent fixtures and can lighting. It is unlikely that the existing lighting would need to be modified at this station.

Power:

We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station. MRN 221 has adequate capacity to support the implementation of a APG/PSD system.

Station
Power Capacity Analysis

NYCT Station MR Number	221
Station Name	21st Street Queensbridge
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	404.0
Apparent Power (kVA)	505.0
Station Peak Demand Load, Max Current, (A)	1402.8
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	1597
Station Service Power Capacity, (Main SB or SG Rating), (A)	3000
Service Spare Capacity, (A)	1403
Is Electrical Service Adequate?	Yes
Notes	Station does not have 1 line diagram. This analysis is based on one meter reading only.

Table 1. MRN 221 Power Capacity Analysis

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.4M to install APGs and $39.8M to install PSDs (See Appendix E)

Figure 3 – Typical platform view with signal box- 21st Street- Queensbridge Station

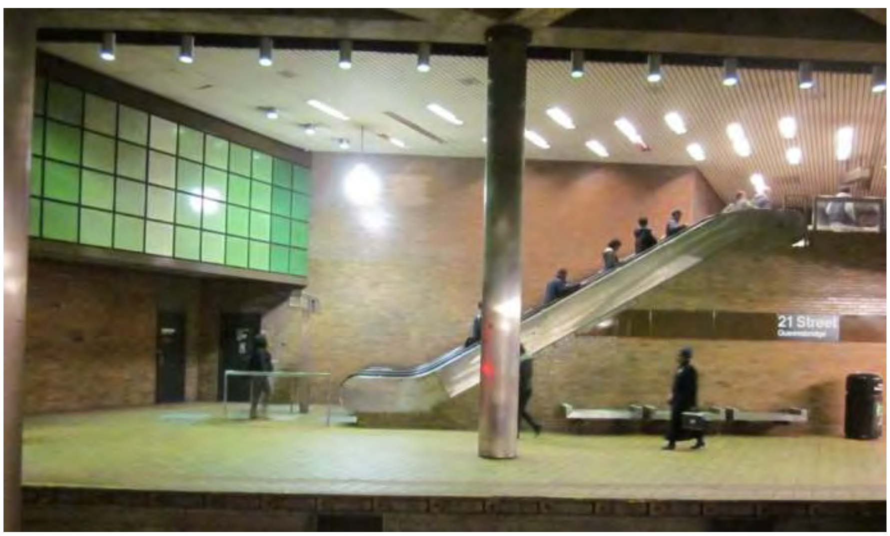


Figure 4 – View of double-height area - 21st Street- Queensbridge Station

1.9 MR-222 | Roosevelt Island Station

Summary: *Roosevelt Island Station (MR-222) is feasible for both APGs and PSDs. There are a variety of conditions in this station including curved or straight walls and ceilings, varying ceiling heights, and different lighting supports. Structural work would only be required in the implementation of APGs (see structural report; Appendix B). Electrical capacity at this station is adequate to support a APG/PSD system.*

Description

Roosevelt Island Station is a below-grade station with two straight side platforms. The platform structure is cast-in-place concrete. Back-of-house elements are located at the end of the platforms and at the mezzanine level. The platforms are column free. Typically, the platform widths are approximately 12'-0". There are a variety of platform conditions, in which the platform is a combination of curved and/or straight walls and ceilings. Ceiling heights vary from 7'-10" to 12'-10". Figures 3 and 4 represent typical platform wall and ceiling combinations as well as various lighting conditions.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the north-end of the Jamaica-bound platform. The proposed room dimension is 7'-0" x 27'-0" (see figure 2).

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edge consists of a cast-in-place concrete cantilever that is approximately 1'-2" long and is approximately 5" thick. The platform also includes a 3" allowance for a floor finish, which was conservatively assumed to be a concrete topping slab for the purpose of assessing dead loads. The cantilever portion is reinforced with #4 rebar at 12" O.C. at the top of the slab. The station was designed in 1975, therefore it was assumed that the reinforcing rods have a yield strength of 40,000 psi (Grade 40) in the absence of additional information (Grade 60 rebar was in existence at the time, but not standard as it is today). The concrete has a compressive strength of 3000 psi, per the notes on the record drawings.

Based upon the record drawings and the above assumptions, it was found that the cantilever edge has sufficient capacity to support a full height PSD system in its current condition. It cannot, however, support

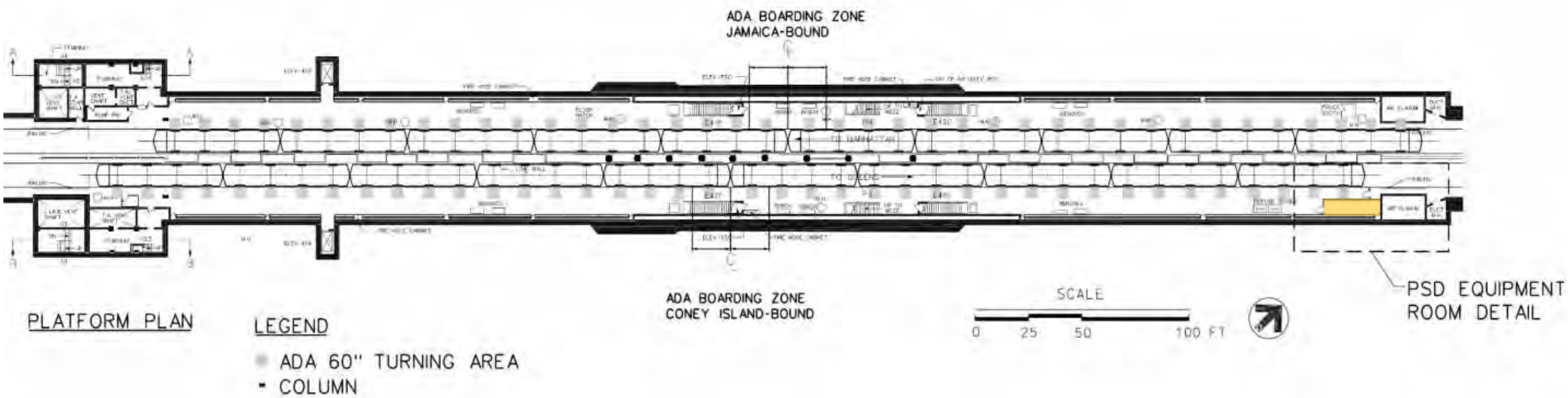


Figure 1 – Station Plan- Roosevelt Island Station

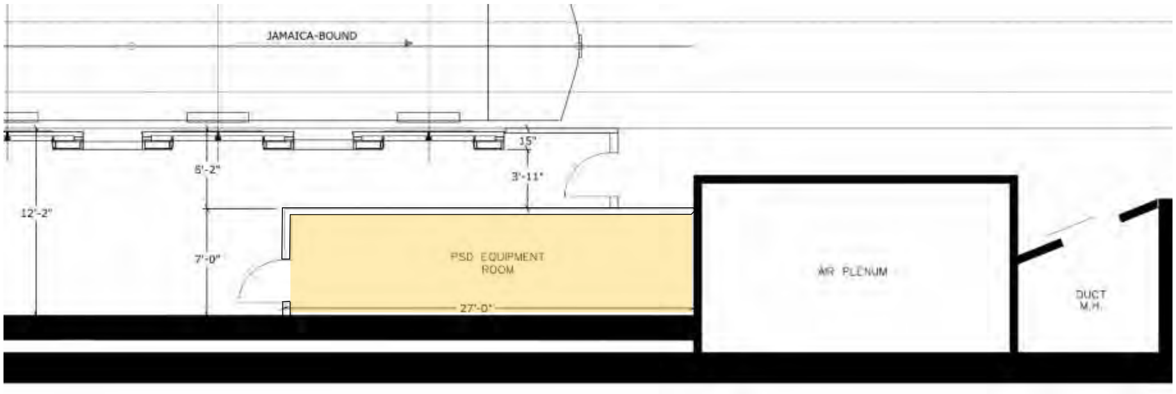


Figure 2 – PSD Equipment Room Detail – Roosevelt Island Station

half height cantilevered APGs without rebuilding the platform edge to achieve a higher strength. This difference is due to the fact the APG system is fully supported at the cantilever edge and results in transfer of moment to the slab edge caused by crowd thrust and wind loading (piston effect), in addition to the weight of the system itself. The PSD system results in a moment on the slab edge due to its weight only. In both cases, self-weight of the slab edge and live load on the platform have been accounted for. The wind load and crowd thrust also result in direct tension on the slab edge, for which the slab has sufficient capacity in either case.

The 2012 NYCT conditions survey gave the platform edges an average rating of 3.25. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

Platform obstructions within 5' of edge:

None.

Lighting:

Existing lighting: Linear fluorescent lighting is surrounded by a continuous 1'-6" tube fixture. The fixtures are 20" from the edge of the platform and have a vertical clearance of 7'-10". As the ceiling heights vary, the lighting is either suspended with angular supports some of which extend over the platform edge (figure 3) or mounted on the ceiling (figure 4). There is also cove lighting along the top of the back wall of the platforms.

Power:

We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station. MRN 222 has adequate capacity to support the implementation of a APG/PSD system.

Station
Power Capacity Analysis

NYCT Station MR Number	222
Station Name	Roosevelt Island
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	555.8
Apparent Power (kVA)	694.8
Station Peak Demand Load, Max Current, (A)	1930.0
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	2125
Station Service Power Capacity, (Main SB or SG Rating), (A)	5500
Service Spare Capacity, (A)	3375
Is Electrical Service Adequate?	Yes
Notes	Station has 2500 A service @ 460 Volt (not 208 V) with max demand of 555.8 KW. We have converted ratings values to 208 V. Station does not have 1 line diagram.

Table 1. MRN 222 Power Capacity Analysis

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.5M to install APGs and $40.8M to install PSDs (See Appendix E)

Figure 3 – Typical platform view featuring curved walls and ceilings- Roosevelt Island Station

Figure 4 – Platform view featuring low planar ceiling with cured and straight walls- Roosevelt Island Station

1.10 MR-223 | Lexington Avenue-63rd Street Station

Summary: *Lexington Avenue-63rd Street Station (MR-223) is feasible for both APGs and PSDs. The recent renovation work at this station conceals the structure at the platform edge. Modifications to this renovation work may be needed to accommodate a PSD system. Structural work would only be required in the implementation of APGs (see structural report; Appendix B). It is assumed that power is adequate.*

Description

Lexington Avenue- 63rd Street Station is a below-grade station with two straight center/island platforms (see figure 1). The platforms are stacked; the upper level provides Coney Island-bound service, while the lower level provides Jamaica-bound service. These platforms also provides Q-line service, similarly with the directions of travel on separate platform levels. This station was renovated in the Second Avenue Subway expansion (opened January 2017). Four elevators are located in a vestibule at the east-end of the station. The platform structure is cast-in-place concrete. Back-of-house elements are located at the end of the platforms and at the mezzanine levels. At the middle of both platforms there are six columns in two rows spaced 8'-0" apart with column faces 4'-6" from the edge of the platform. In addition to these columns, the lower level has a row of columns centered on the platform width spaced 15'-0" on center. At the upper level, there are ceiling mounted metal panels that are angled and extend beyond the platform edge (see figure 3). At the lower level, there are horizontal metal mesh panels covering the beams at and beyond the platform edge (see figure 4).

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Due to the treatment of the ceilings at and beyond the platform edge, modification of metal panels may be necessary to create the supporting structure of a full height system.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

This station will need two equipment rooms as there are four platform edges. For the two F-line platform edges, one room can be located in the middle of the lower level platform between the existing columns. The proposed room dimension is 12'-0" x 16'-0" (see figure 2).

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

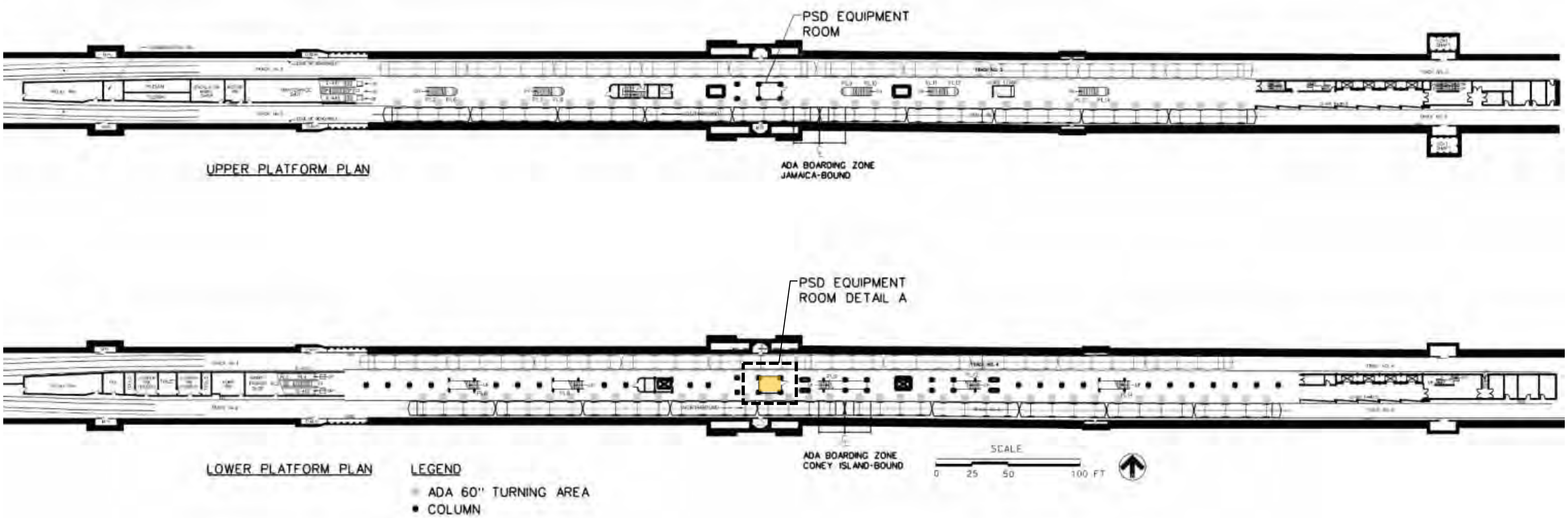


Figure 1 – Station Plan- Lexington Ave.-63rd St. Station

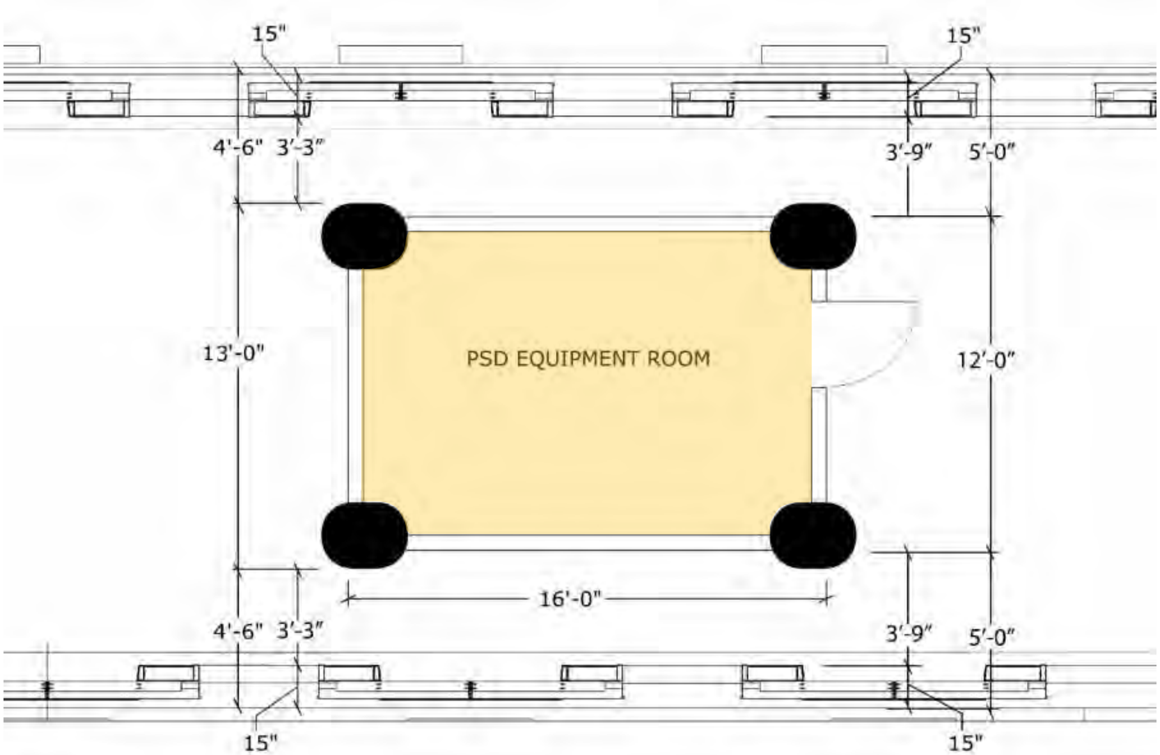


Figure 2 – PSD Equipment Room Detail – Lexington Ave.-63rd St. Station

Platform Edge Condition

The platform edge consists of a cast-in-place concrete cantilever that is approximately 1'-2" long and is approximately 5" thick. The platform also includes a 3" allowance for a floor finish, which was conservatively assumed to be a concrete topping slab for the purpose of assessing dead loads. The cantilever portion is reinforced with #4 rebar at 12" O.C. at the top of the slab. The station was designed in 1975, therefore it was assumed that the reinforcing rods have a yield strength of 40,000 psi (Grade 40) in the absence of additional information (Grade 60 rebar was in existence at the time, but not standard as it is today). The concrete has a compressive strength of 3000 psi, per the notes on the record drawings.

Based upon the record drawings and the above assumptions, it was found that the cantilever edge has sufficient capacity to support a full height PSD system in its current condition. It cannot, however, support half height cantilevered APGs without rebuilding the platform edge to achieve a higher strength. This difference is due to the fact the APG system is fully supported at the cantilever edge and results in transfer of moment to the slab edge caused by crowd thrust and wind loading (piston effect), in addition to the weight of the system itself. The PSD system results in a moment on the slab edge due to its weight only. In both cases, self-weight of the slab edge and live load on the platform have been accounted for. The wind load and crowd thrust also result in direct tension on the slab edge, for which the slab has sufficient capacity in either case.

As this station was recently renovated, the platform edge score from the 2012 NYCT conditions survey is not a reflection of current conditions.

Platform obstructions within 5' of edge:

Coney Island-bound: There are three columns that are 4'-7" away from the platform edge.

Jamaica-bound: There are three columns that are 4'-7" away from the platform edge.

Lighting:

Existing lighting: Lighting comprises of 1'-6" fluorescent tubes recessed above removable ceiling panels, and encased fluorescent tubes installed approximately 60" away from the platform edge

Power:

This information was not ascertainable at the time of the survey. However, we do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.6M to install APGs and $39.3M to install PSDs (See Appendix E)

Figure 3 – Platform edge condition on the lower level (Coney Island-bound)- Lexington Ave.-63rd St. Station

Figure 4 –Platform edge condition on the lower level (Jamaica-bound)- Lexington Ave.-63rd St. Station

1.11 MR-224 | 57th Street Station

Summary: *57th Street Station (MR-224) is not feasible for both APGs and PSDs. The implementation of a platform edge barrier would result in non-compliant ADA conditions that would not allow for ADA compliant wheelchair movement along the length of the platform. At some stairs, the 32" minimum requirement for wheel chair circulation would not be met on one side of the platform. See figure 1 for the typical non-compliant condition occurring on one side of the platform.*

Description

57th Street Station is a below-grade station consisting of one straight center/island platform. The cast-in-place concrete platforms are accessed via a mezzanine. There are six stairs on the platform. Four of these stairs are shifted towards one side of the platform adjacent to columns. The platform is approximately 23'-0" wide. Column spacing along the length of the platform is approximately 15' on center and column faces are typically 3'-4" to the edge of the platform. Currently, at all stairs along the length of the platform, a wheel chair can move between the columns and the platform edge (3'-4"). Four of the six stairs are off center as shown in figure 1. Although there is adequate clear space on one side of the platform, the implementation of a platform edge barrier would not allow for ADA compliant wheelchair movement at the other side. Both platform edges need to comply in order for the station to be deemed feasible for the implementation of a platform edge barrier.

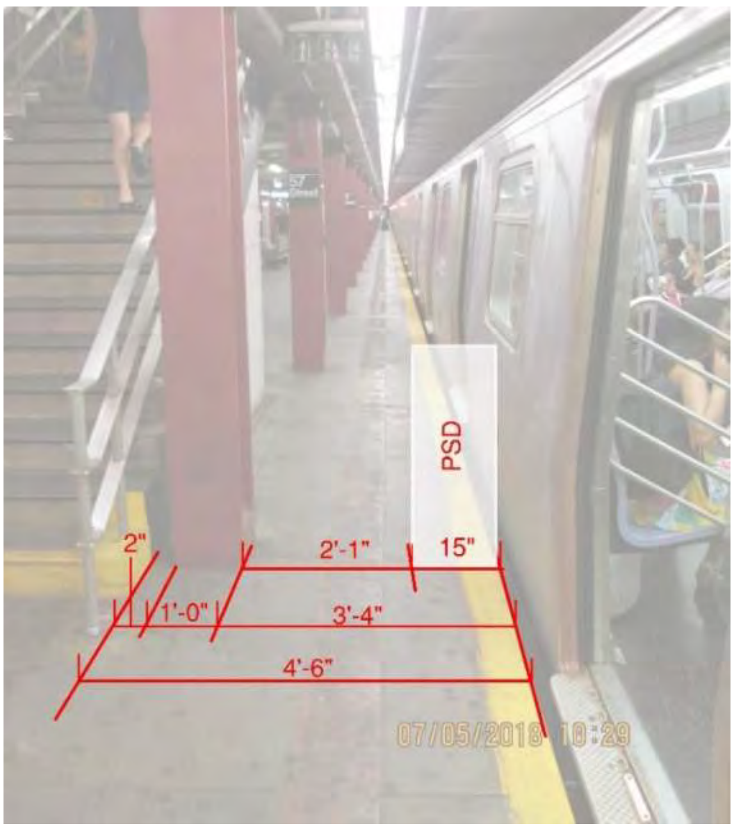


Figure 1 – Non-compliant ADA condition on one side of the center/island platform- 57th Street

1.12 MR-232 | 2nd Avenue Station

Summary: *2nd Avenue (MR-232) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. There a flue vents located at the center of both platforms, flanked by columns on both sides of the platform. The ADA constraints occur due to columns surrounding the vent flues on both center/island platforms. Currently, the distance between the column and the edge of the platform is 36" and the spacing between the column and the wall of the vent flue is 18" on one side and 30" on the other. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA compliant wheelchair movement would not be met at vent flues as the remaining width would be 21" (see figure 1).*

Description

2nd Avenue Station is a below-grade station with two straight center/island platforms. The platform structure is cast-in-place concrete. The width of both platforms is approximately 19'-4". A vent is centered on both the Jamaica-bound and Coney Island-bound platforms. Currently, there is an ADA compliant path of travel between the column face and the platform edge (3'-0"). The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 21" would not allow for ADA compliant wheelchair movement.

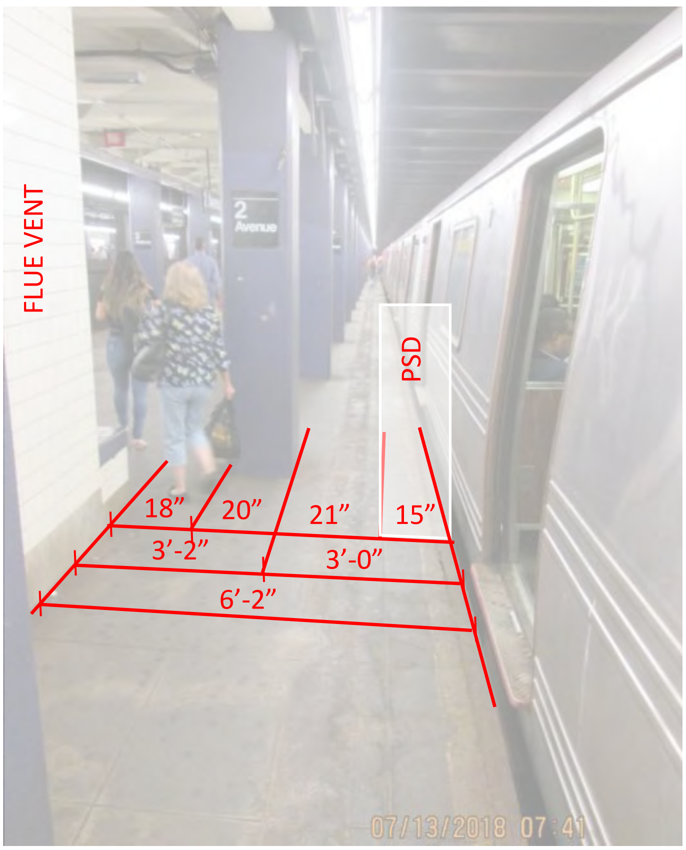


Figure 1 – Non-compliant ADA condition at flue vent- 2nd Avenue Statio

1.13 MR-233 | Delancey Street Station

Summary: *Delancey Street Station (MR-233) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, there are two locations along the Jamaica-bound platform that would result in non-compliant conditions. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA compliant wheelchair movement would not be met due to the location of an existing escalator and an escalator pit room. In the implementation of a platform edge barrier, the widest remaining widths in either situation would be 30" and 26" respectively (see figures 1 and 2).*

Description

Delancey Street Station is a below-grade station with straight side platforms. The platform structure is cast-in-place concrete. The width of both side platforms is approximately 12'-8". Columns are spaced 15'-0" on center with faces 3'-0" from the platform edge. Currently, there is an ADA-compliant path of travel between columns and the platform edge (3'-0"). The implementation of a platform edge barrier would reduce this width below the required minimum of 32" at two specific locations on the Jamaica-bound platform (see figures 1 and 2). Remaining widths would not allow for ADA compliant wheelchair movement.

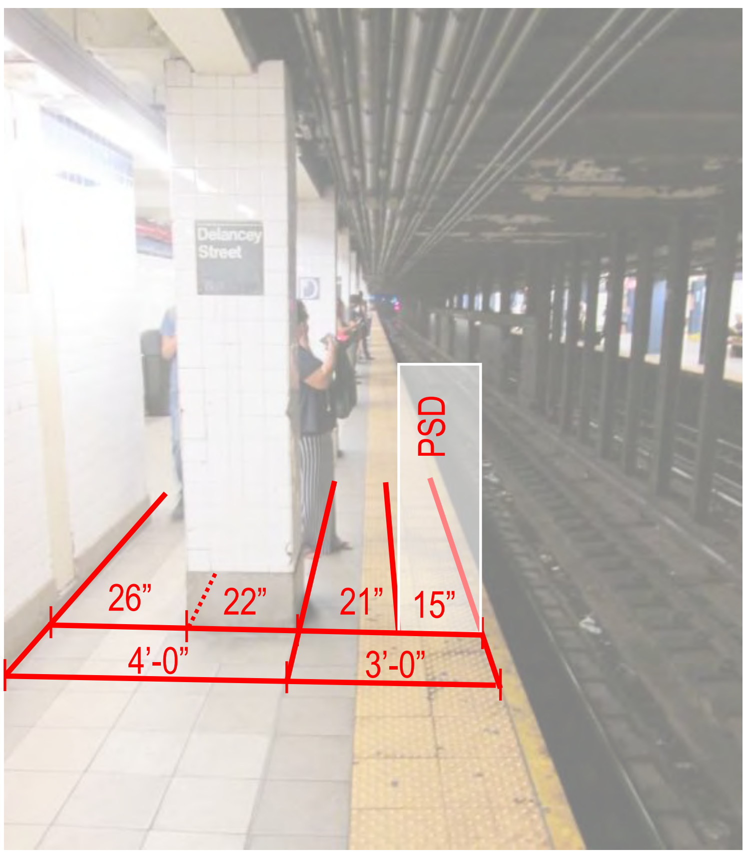


Figure 1 – Non-compliant ADA condition at escalator 328- Delancey Street Station

1.14 MR-234 | East Broadway Station

Summary: *East Broadway Station (MR-234) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA compliant wheelchair movement would not be met at five of the seven stairs/escalators. The remaining width would be 25" (see figure 1). The stairs/escalators at this station are typically off-center, located closer to the local track platform edge. Currently, columns divide the 6'-0" width between the platform edge and the stairs/escalators.*

Description

East Broadway Station is a below grade station with a straight center/island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 17'-6". Columns are spaced 15'-0" on center with column faces 3'-4" from the platform edge. Passengers requiring an ADA compliant path can currently move in the 3'-4" space between the stairs and platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 25" would not allow for ADA compliant wheelchair movement.

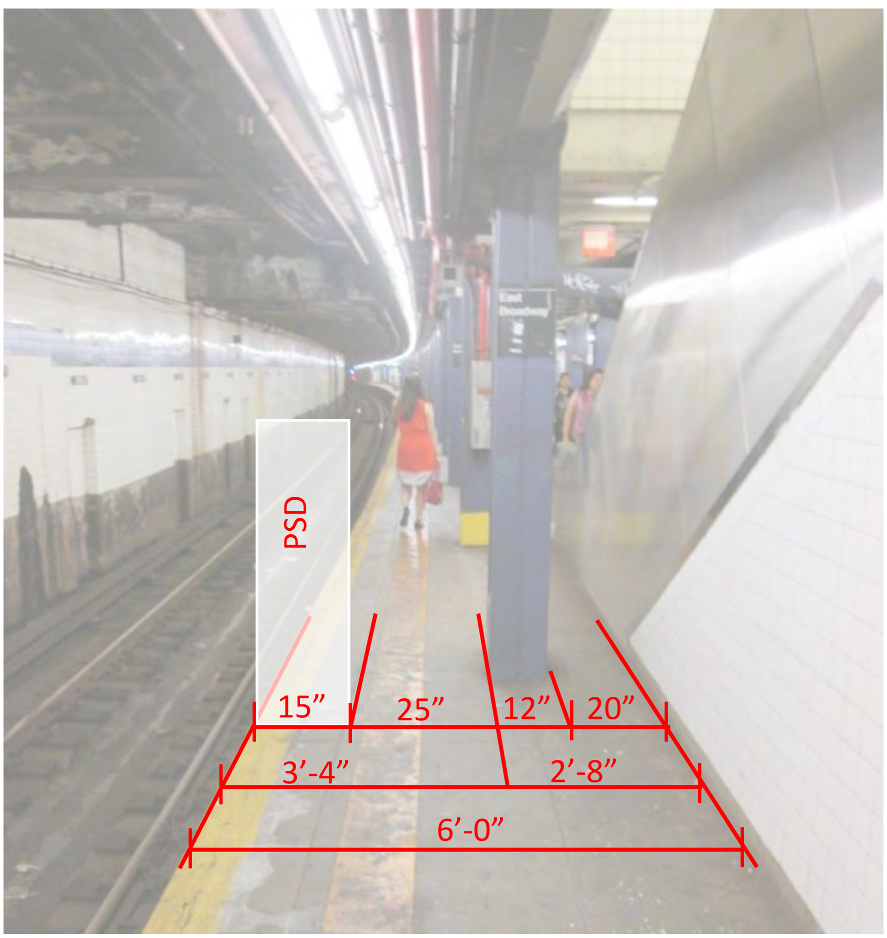


Figure 1 – Non-compliant ADA condition at stairs/escalator (typical)- East Broadway Station

1.15 MR-235 | York Street Station

Summary: *York Street Station (MR-235) is feasible for both APGs and PSDs. There is area at the south-end of the platform where a PSD equipment room can be located. Platform structural work will be required to support the requirements of an APG or PSD system (see structural report; Appendix B). It is assumed that existing power is adequate.*

Description

York Street Station is a below-grade station with a straight center/island platform (see figure 1). The platform has one stair at the north-end of the platform. The platform structure is cast-in-place concrete. Back-of-house elements are situated in the mezzanine, which is connected to the station platform through a ramp passageway. The platform width is approximately 18'-8" wide. There are two rows of columns that are spaced 15'-0" on center, with column faces 2'-8" from the platform edge. The distance between the two rows of columns is typically 11'-0". For an overall station plan, see figure 1. See figure 3 for a typical platform view.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, entrapment prevention sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be CCTV cameras over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Wall-mounted and hung conduits below the platform edge would need to be relocated to accommodate the requirements of the APG system.

Equipment Room

One room can be accommodated at the south-end of the platform. The proposed room dimension is 12'-0" x 16'-0" (see figure 2).

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

Structural work should be required for the installation of an APG or PSD system due to the current platform edge condition rating. The 2012 NYCT conditions survey gave the platform edges an average rating of 2.75. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair

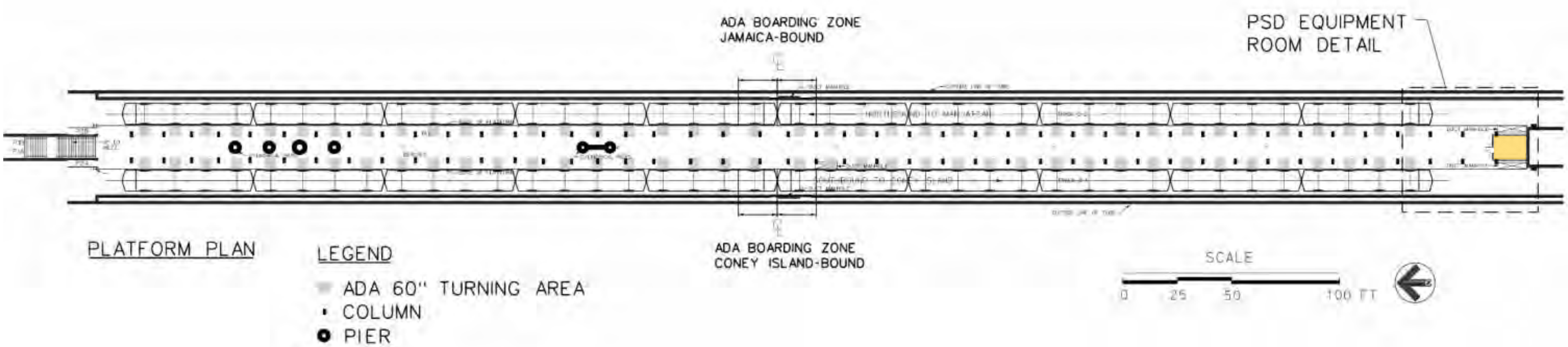


Figure 1 – Station Plan-York Street Station

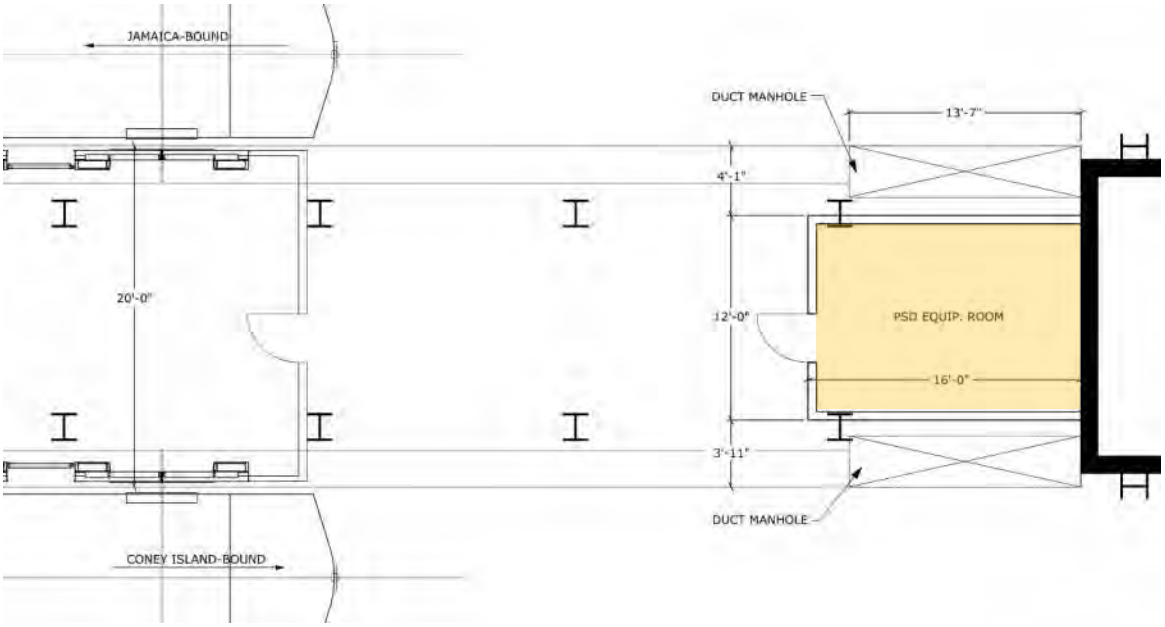


Figure 2 – PSD Equipment Room Detail – York Street Station

Platform obstructions within 5' of edge:

All columns are 32" from the platform edge. Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A.

Lighting:

Existing lighting: Linear fluorescent; approximately 1' from the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This information was not ascertainable at the time of the survey. However, we do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Historic Restrictions:

None.

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.5M to install APGs and $41.2M to install PSDs (See Appendix E).

Figure 3– Typical platform view- York Street Stati

1.16 MR-174 | Jay Street-MetroTech Station

Summary: *Jay Street-MetroTech Station (MR-174) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. The platforms serving the 'F' line also serve the 'A' and 'C' lines. In the implementation of a platform edge barrier, the 32" minimum pinch width requirement for ADA compliant wheelchair movement would not be met at several stairs on both platforms. These stairs are not centered on the width of the platform, but are closer to the 'A' and 'C' track side of the platform. In these conditions, the remaining width would be 27" (see figure 1). Although the minimum required circulation width is met on one side of the platform, compliance is required on both sides of the platform in order to be feasible.*

Description

Jay Street-MetroTech Station is a below-grade station with two straight center/island platforms. The platform structure is cast-in-place concrete and serves the 'F', 'A', and 'C' lines. The width of the platform is approximately 24'-8". Columns are spaced 15'-0" on center with column faces 3'-6" away from the platform edge. The columns on the northbound (Jamaica-179th Street) platform are exposed, while on the southbound (Coney Island-Stillwell Avenue) platform have a tile surround. On both platforms, column faces are 3'-6" from the platform edge. Currently, there is an ADA-compliant path of travel between columns and the platform edge (3'-6"). The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 27" would not allow for ADA compliant wheelchair movement.

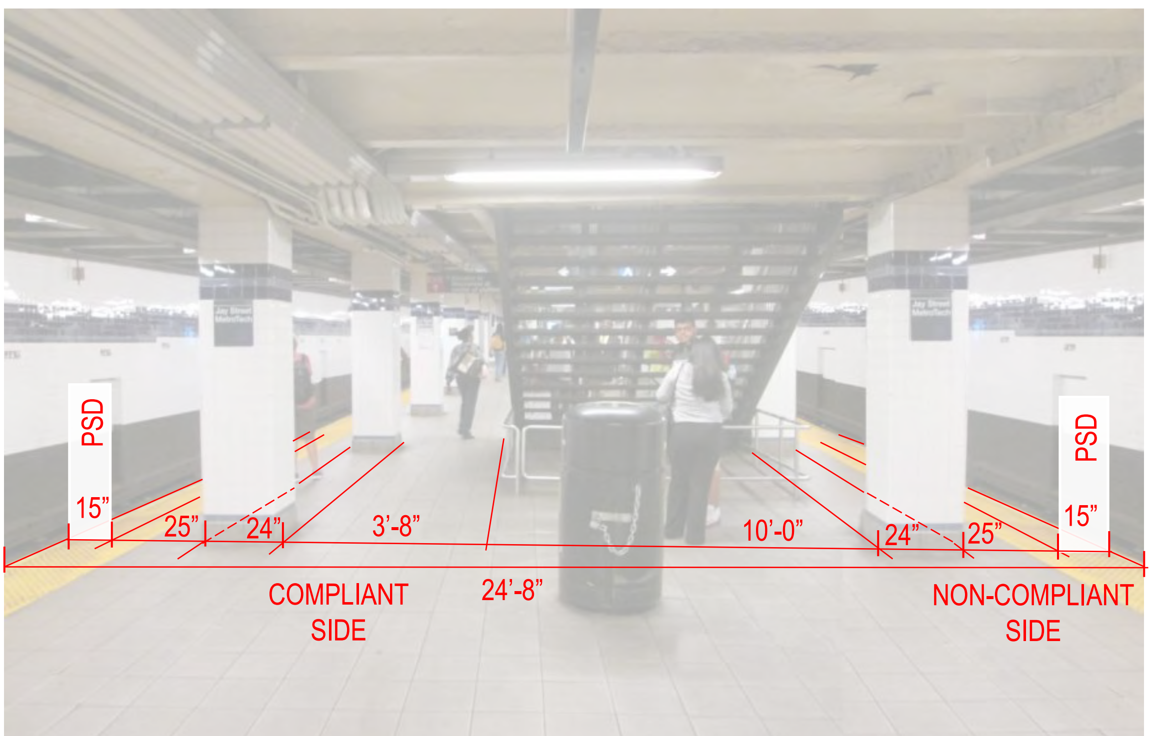


Figure 1 – Non-compliant ADA condition on one side of platform (southbound)- Jay Street- MetroTech Station

1.17 MR-244 | Ditmas Avenue Station

Summary: *Ditmas Avenue Station (MR-244) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2). Additionally, the implementation of a platform edge barrier would result in non-compliant ADA conditions. At the stairs on the north-end of both platforms, the 32" required width would not be met (see figure 1).*

Description:

Ditmas Avenue Station is an elevated station consisting of two side platforms. Both platforms are 11'-4" wide. The platform is straight with a row of a columns against the back wall of the platform. The canopy covers the entirety of the platform length. See figure 1 for a general platform view of Ditmas Avenue Station. The stair at the north-end of the platform is 3'-6" away from the platform edge. In the implementation of a platform edge barrier, the remaining width at the stair would be insufficient for wheelchair movement.

Figure 1– Non-compliant ADA Condition – Ditmas Avenue Station

Figure 2– Precast T-Beam platform – Ditmas Avenue Station

1.18 MR-245 | 18th Avenue Station

Summary: *18th Avenue Station (MR-245) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2). Additionally, the implementation of a platform edge barrier would result in non-compliant ADA conditions. At the stairs on the north-end of both platforms, the 32" required width would not be met (see figure 1).*

Description:

18th Avenue Station is an elevated station consisting of two center/island platforms, one of which is currently not in service. The accessible platform is 16'-4" wide. The platform is straight with a row of columns centered on the width of the platform. The canopy covers the entirety of the platform length. The stair at the north-end of the platform is 3'-6" away from the platform edge. In the implementation of a platform edge barrier, the remaining width at the stair would be insufficient for wheelchair movement.

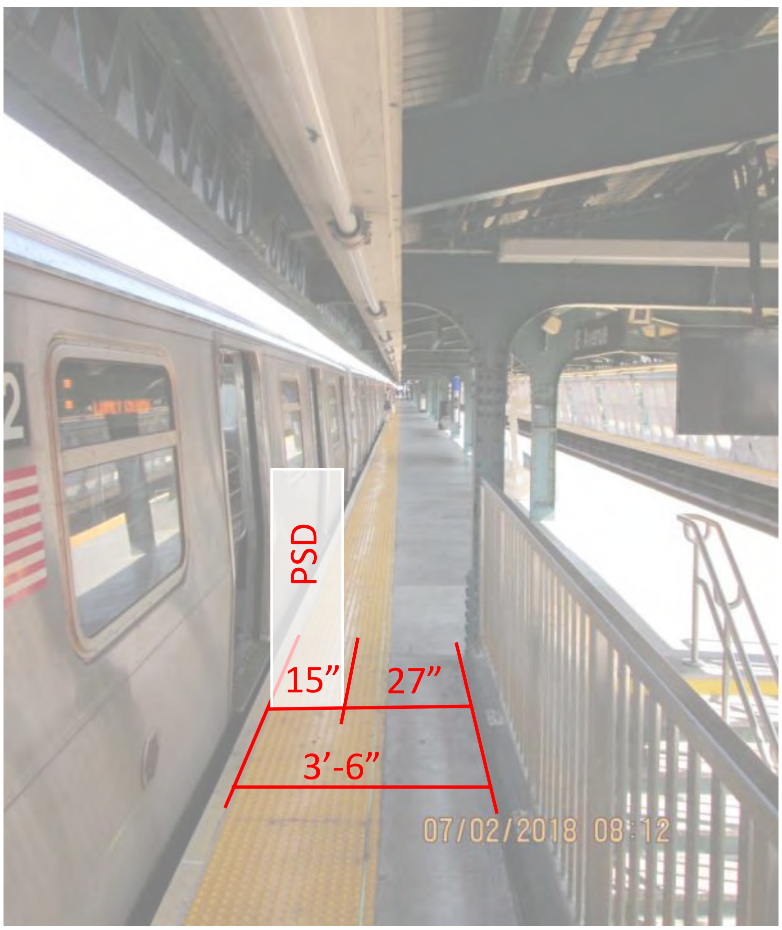


Figure 1– Non-compliant ADA condition – 18th Avenue Station

Figure 2– Precast T-Beam platform – 18th Avenue Station

1.19 MR-246 | Avenue I Station

Summary: *Avenue I Station (MR-246) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2). Additionally, the implementation of a platform edge barrier would result in non-compliant ADA conditions. At the stairs on the south-end of both platforms, the 32" required width would not be met as the remaining width would be 17" (see figure 1).*

Description:

Avenue I Station is an elevated station consisting of two side platforms, one of which is currently not in service. Each platform is 11'-4" wide. The platform is straight with a row of a columns against the back wall of the platform, which supports the station canopy. The canopy covers the entirety of the platform length. The stair at the south-end of the platform is 32" away from the platform edge. In the implementation of a platform edge barrier, the remaining width adjacent to the stair would be insufficient for wheelchair movement.

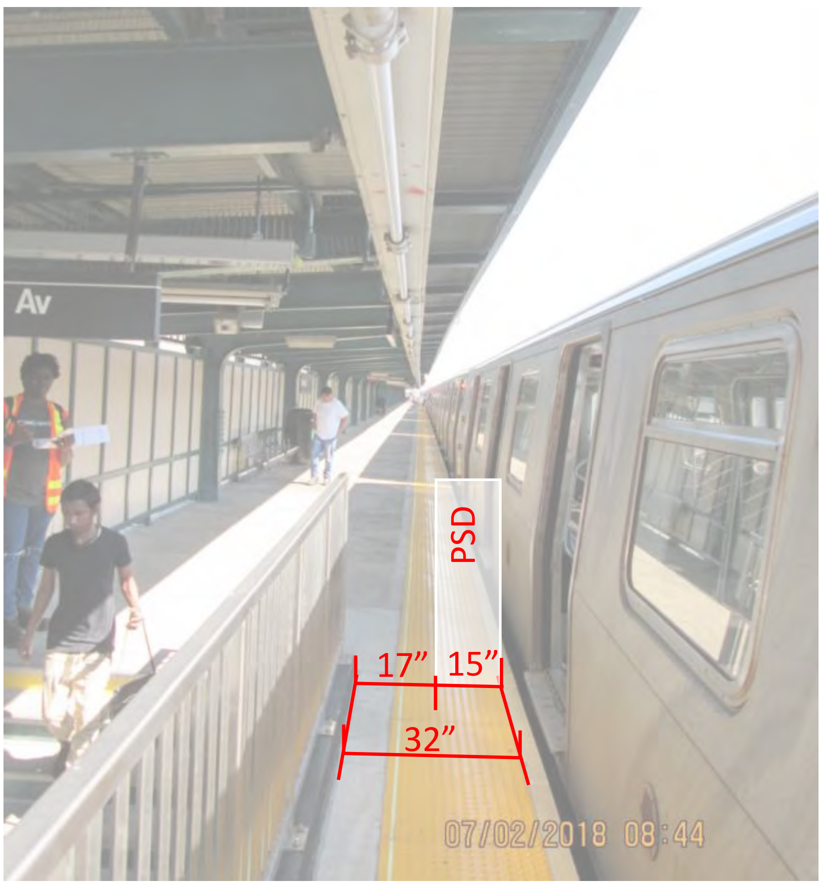


Figure 1– General Platform Condition – Avenue I Station

Figure 2– Precast T-Beam platform – Avenue I Station

1.20 MR-247 | Bay Parkway Station

Summary: *Bay Parkway Station (MR-247) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2).*

Description:

Bay Parkway Station is an elevated station consisting of two side platforms, one of which is currently not in service. Each platform is 11'-4" wide. The platform is straight with a row of a columns flush with the wall of the platform, which supports the station canopy. The canopy covers approximately half of the platform, which is found to be inadequate cover for a full height PSD system. See figure 1 for a general platform view of Bay Parkway Station.

Figure 1– General Platform Condition – Bay Parkway Station

Figure 2– Precast T-Beam platform – Bay Parkway Station

1.21 MR-248 | Avenue N Station

Summary: *Avenue N Station (MR-248) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2). Additionally, the implementation of a platform edge barrier would result in non-compliant ADA conditions. At the stairs on the north-end of both platforms, the 32" required width would not be met (see figure 1).*

Description:

Avenue N Station is an at-grade station consisting of two side platforms, one of which is currently not in service. Each platform is 11'-4" wide. The platform is straight with a row of a columns flush with the wall of the platform, which supports the station canopy. The canopy covers the entirety of the platform length. The stair at the south-end of the platform is 28" away from the platform edge. This width is currently not ADA compliant and the implementation of a platform edge barrier would further exacerbate this condition.

Figure 1– General Platform Condition – Avenue N Station

Figure 2– Precast T-Beam platform – Avenue N Station

1.22 MR-249 | Avenue P Station

Summary: *Avenue P Station (MR-249) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2). Additionally, the implementation of a platform edge barrier would result in non-compliant ADA conditions. The stairs are located at the center of the platform and are 3'-8" (44") away from the platform edge. In the implementation of a platform edge barrier, the 32" required width would not be met as the remaining width would be approximately 29" (see figure 1).*

Description:

Avenue P Station is an at-grade station consisting of two side platforms, one of which is currently not in service. Each platform is 11'-4" wide. The platform is straight with a row of a columns against the wall of the platform, which supports the station canopy. The canopy covers the entirety of the platform length. The centrally located stairs are 3'-8" (44") away from the platform edge. The implementation of a platform edge barrier would not allow for ADA compliant wheelchair movement.

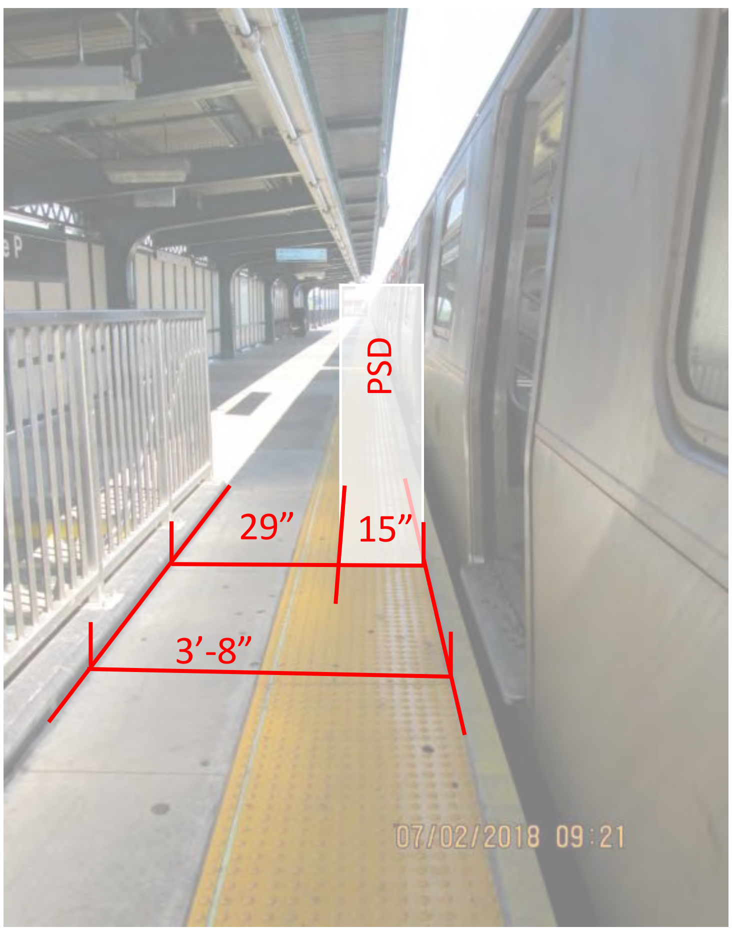


Figure 1– Non-compliant ADA condition at stairs – Avenue P Station

Figure 2– Precast T-Beam platform – Avenue P Station

1.23 Mr-250 | Kings Highway Station

Summary: *Kings Highway Station (MR-250) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2).*

Description:

Kings Highway Station is an at-grade station consisting of two center/island platforms, one of which is currently not in service. Each center platform is 16'-4" wide. The platform has a singular row of columns supporting a canopy with a spacing of 7'-8" from the column to the edge of the platform. The canopy covers the entirety of the platform length. See figure 1 for a general platform view of Kings Highway Station.

Figure 1– General Platform Condition – Kings Highway Station

Figure 2– Precast T-Beam platform – Kings Highway Station

1.24 MR-251 | Avenue U Station

Summary: *Avenue U Station (MR-251) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2). In addition, the stair on the south-end of both platforms is located 2'-8" (32") from the platform edge. In the implementation of a platform edge barrier, the remaining width would not allow for ADA-compliant wheelchair movement (see figure 1).*

Description:

Avenue U Station is an elevated station consisting of two center platforms, one of which is currently not in service. Each center platform is 11'-4" wide. The platform is straight with a row of a columns against the wall of the platform. The canopy covers the entirety of the platform length. The stairs at the south-end of both platforms is close to the platform edge and would not allow for ADA-compliant wheelchair movement with a platform edge barrier installed.

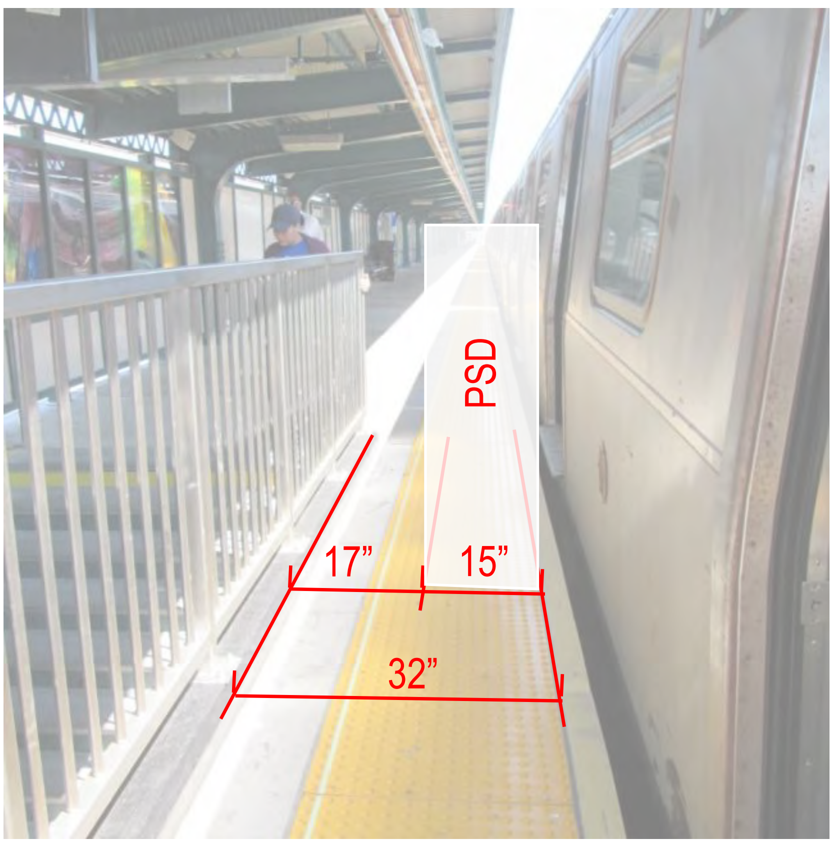


Figure 1– Non-compliant ADA condition at stairs– Avenue U Station

Figure 2– Precast T-Beam platform – Avenue U Station

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1.25 MR-252 | Avenue X Station

Summary: *Avenue X Station (MR-252) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2). In addition, the stair on the north-end of the Jamaica-bound platform is located 3'-8" (44") from the platform edge. In the implementation of a platform edge barrier, the required 32" width for wheelchair movement would not be met as the remaining width would be 29" (see figure 1).*

Description:

Avenue X Station is an elevated station consisting of two side platforms. Each side platform is approximately 10'-0" wide. The platform is slightly curved with a row of a columns against the back wall of the platform. The canopy covers the entirety of the platform length. The stair at the north-end of the Jamaica-bound platform is close to the platform edge. In this location, the required 32" width for ADA compliant wheelchair movement would not be met with a platform edge barrier installed.

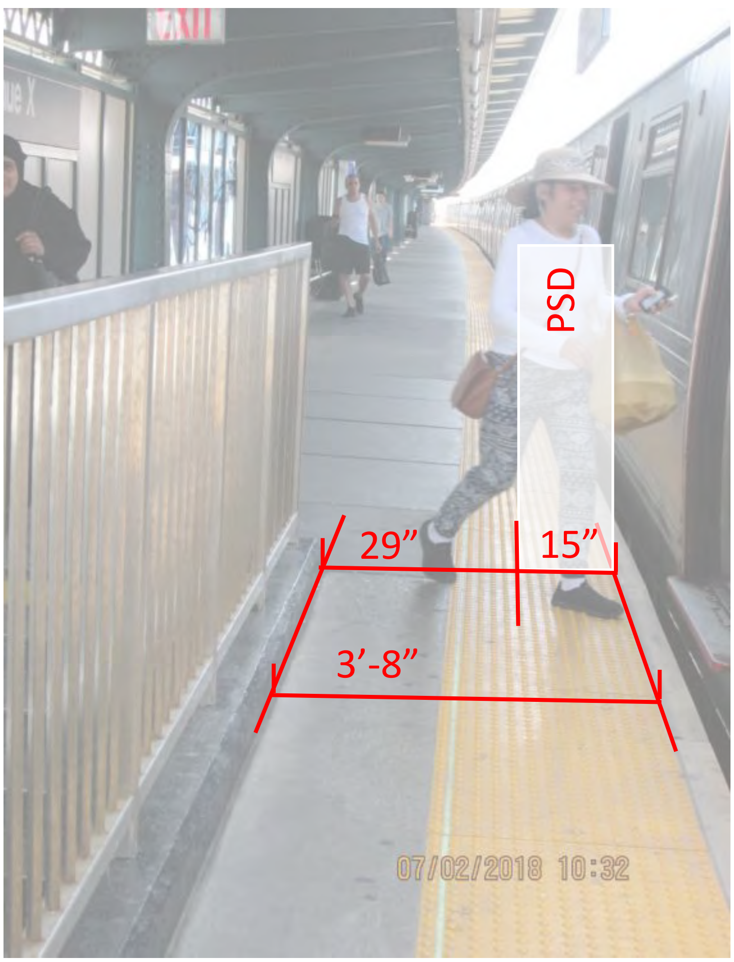

Figure 1– Non-compliant ADA condition – Avenue X Station

Figure 2– Precast T-Beam platform – Avenue X Station

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1.26 MR-253 | Neptune Avenue Station

Summary: *Neptune Avenue Station (MR-253) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2). In addition, at the centrally located stairs are 3'-10" (46") away from the platform edge. In the implementation of a platform edge barrier, the required 32" width for wheelchair movement would not be met as the remaining width would be 31" (see figure 1).*

Description:

Neptune Avenue Station is an elevated station consisting of a straight center/island platform. The platform is approximately 15'-2" wide. Columns are centered on the width of the platform. Full height PSDs would not be feasible as there is limited canopy cover. The centrally located stairs are close to the platform edge. Adjacent to the stairs, the required 32" width for ADA compliant wheelchair movement would not be met with a platform edge barrier installed.

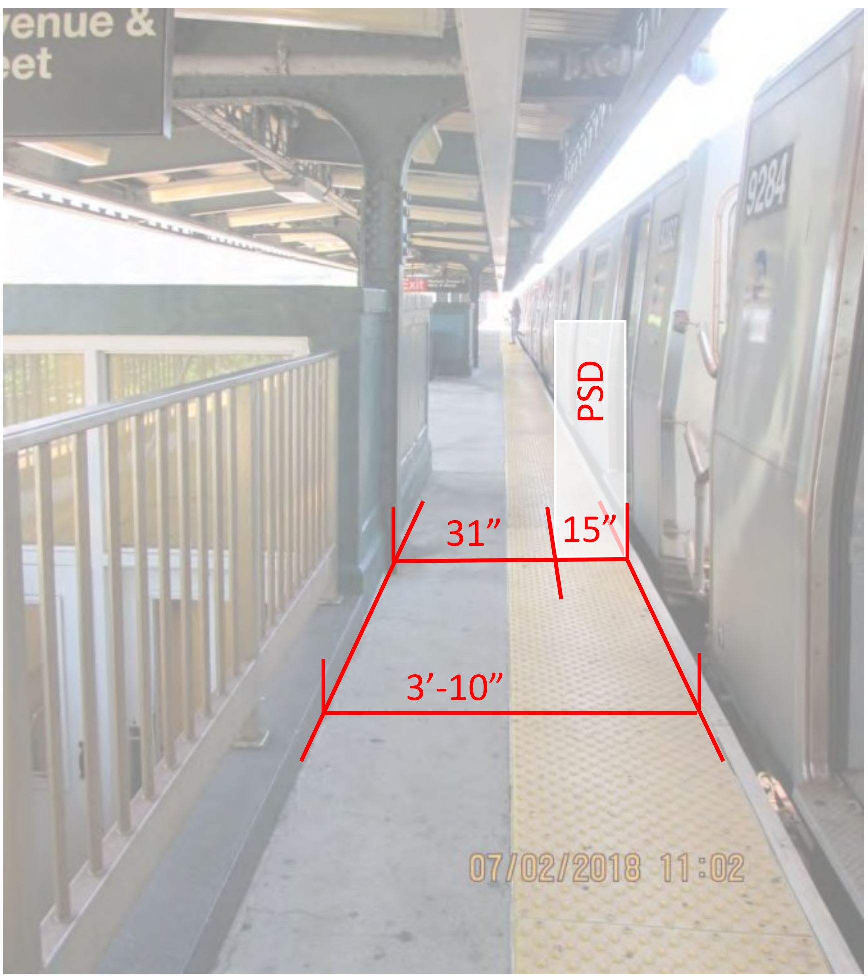

Figure 1– General Platform Condition – Neptune Avenue Station

Figure 2– Precast T-beam Platform – Neptune Avenue Station

1.27 MR-57 | West 8th Street- NY Aquarium Station

Summary: *West 8th Street- NY Aquarium Station (MR-57) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. This issue would occur due to the elevator/escalator room located on the Jamaica-bound platform. A column divides the width between the existing room and the platform edge. This column currently does not allow for wheelchair movement on the Jamaica-bound platform. The 32" minimum requirement for ADA compliant wheelchair movement is currently not met and would be exacerbated in the implementation of a platform edge barrier (see figure 1).*

Description

West 8th Street- NY Aquarium Station is an elevated station with slightly curved side platforms that serve the 'F' and 'Q' trains. The lower platform level serves the 'F' line and the upper platform serves the 'Q' line. The platform structure is cast-in-place concrete. The width of the platform varies from 12'-10" to 5'-2". Columns are typically 2'-3" from the platform edge. Currently, the station does not have an ADA compliant path of travel along the Jamaica-bound platform. The elevator/escalator room is 5'-2" from the platform edge a column segments this width into a 1'-4" and a 2'-4" path of travel. The implementation of a platform edge barrier would further constrain this non-compliant condition.

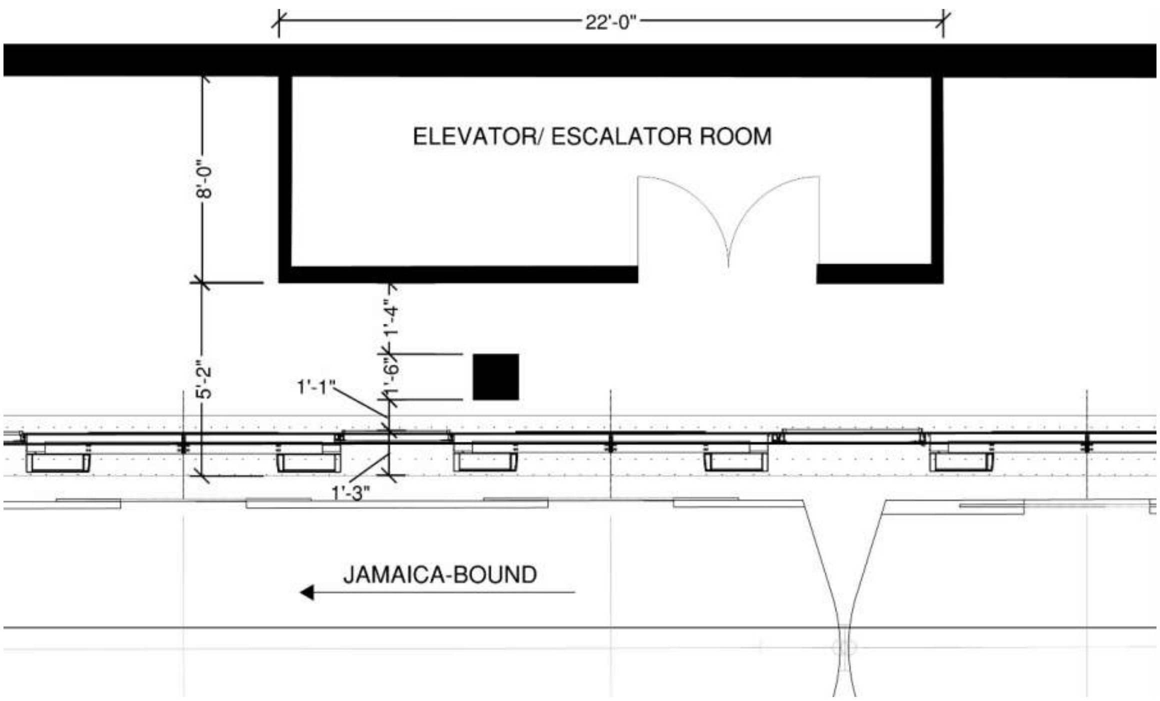

Figure 1 – Non-compliant ADA condition on the Jamaica-bound platform- West 8th St-NY Aquarium

1.28 MR-58 | Coney Island-Stillwell Avenue Station

Summary: *Coney Island-Stillwell Avenue Station (MR-58) is feasible for both APGs and PSDs. This station is the terminus station for the 'N', 'Q', 'D', and 'F' trains. Tracks 5 and 6 serve the F line from a shared center/island platform. The canopy at this station is very tall, and there are no structural members directly above the platform edge. For the installation of a full height PSD system, structural members would have to be attached to existing beams that are approximately 12'-0" high and 5'-0" from the platform edge. One and a half train cars are not covered by a canopy, supplemental overhead structure would be needed in this small along the platform. Platform structural work will be required to support the requirements of an APG and PSD system (see structural report; Appendix B). Existing power is adequate.*

Description

Coney Island-Stillwell Avenue Station is an elevated station with four center/island platforms (see figure 1). Each train that is served at this station has a center/island platform for its use only. The 'F' line platform is mostly straight, but tapers at the north-end of the platform. The platform structure is made of cast-in-place concrete. There are two stairs and a centrally located ramp that provide access to the mezzanine level below. Back-of-house elements are situated on the platform ends and in the mezzanine. There are two rows of columns along the length of the platform. These columns are spaced approximately 20'-0" on center with column faces 6'-10" from the platform edge. The platform varies from 20'-0" to 26'-0" wide. One and a half train cars are not covered by the canopy, a supplementary overhead structure would be required in these locations to accommodate a platform edge barrier. See figure 1 for an overall station plan.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. As indicated in the summary, there is not structure to mount to directly above the platform edge, some additional framing would be needed in this station (see figure 3).

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, entrapment prevention sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be CCTV cameras over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Minimal overhead structure would be needed to accommodate cameras and sensors in the small portion of the platforms not covered by canopies

Equipment Room

One room can be accommodated on the platform between columns at the center of the platform. The proposed room would measure approximately 16'-0" x 7'-6" (see figure 2). The other lines that are served at this station could use a similar room location on their respective platform (see figure 1)

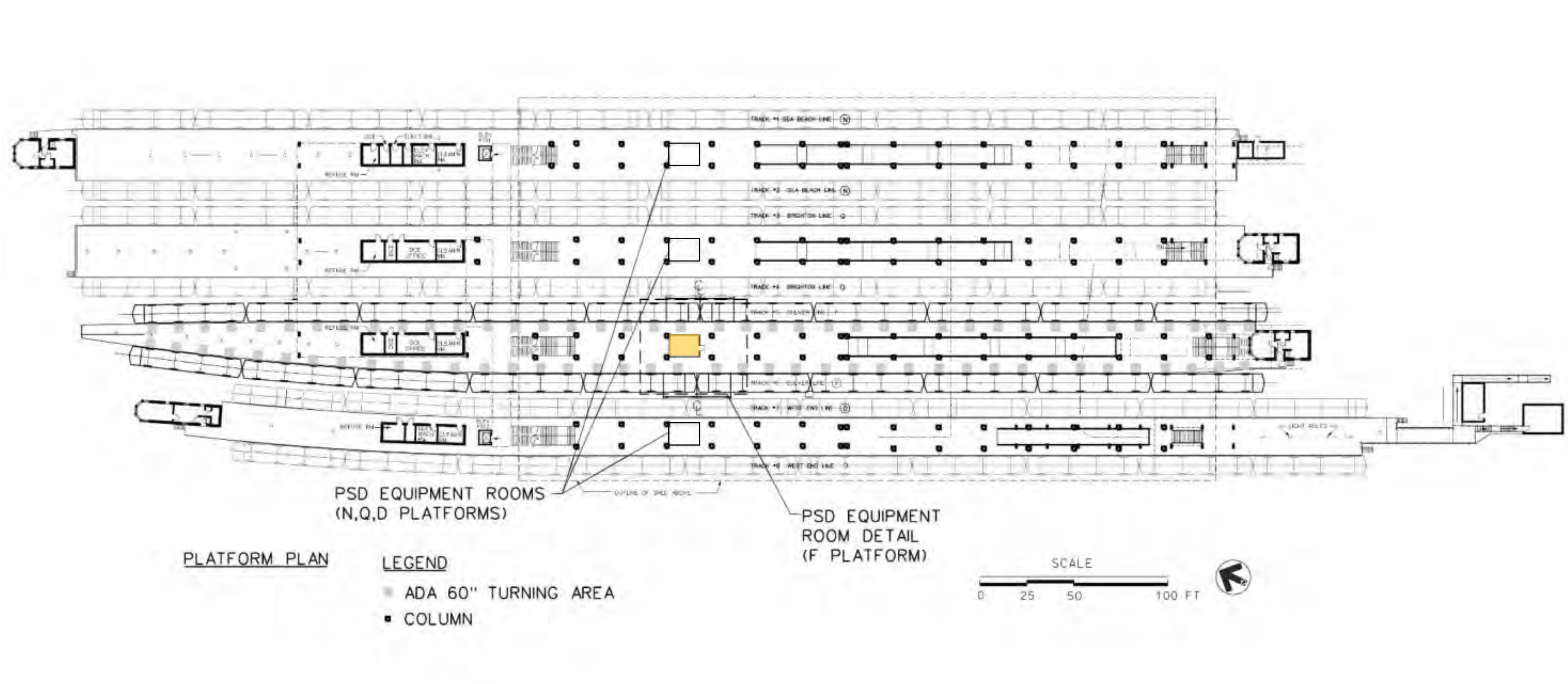

Figure 1 – Station Plan- Coney Island-Stillwell Avenue Station

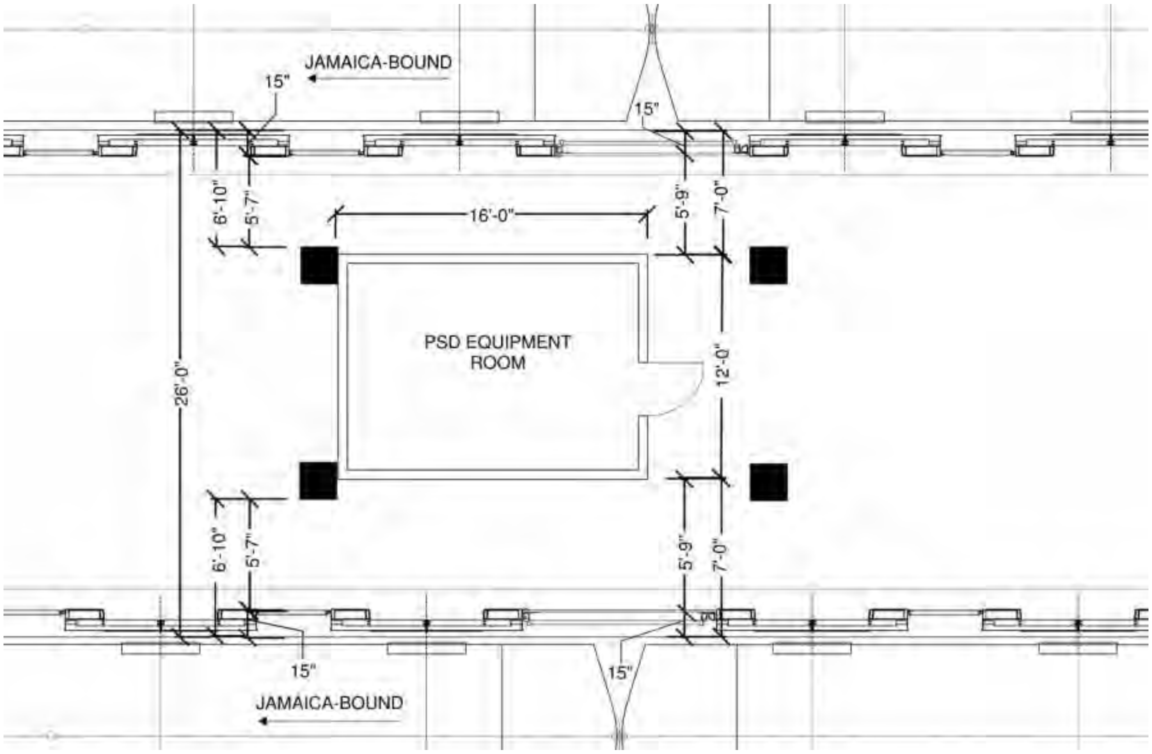

Figure 2 – PSD Equipment Room Detail – Coney Island-Stillwell Avenue Station

Track Layout

Tracks are mostly tangent with the exception of the tapered north-end of the platform. Thus, we are expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

Existing conditions. The 2012 NYCT conditions survey for this station could not be obtained at the time of drafting this report. However it should be noted this station underwent a major rehabilitation in 2005. It can be safely assumed that major reconstruction would be required to implement either a PSD or APG system at this station. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would be required for the installation of an APG system and PSD system. The APG due to its cantilevered configuration and the PSD due to there being no components above it to mount to provide support and stability.

Platform obstructions within 5' of edge:

None.

Lighting:

Existing lighting: This station has a lot of natural daylight, however there are also linear fluorescent lights below the beams that run parallel to the platform. These beams are approximately 12'-0" high and 5'-0" from the edge of the platform. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 and Table 2 please see the Power Capacity Analysis for this station. MRN 058 has adequate capacity to support the implementation of a APG/PSD system only through the reserve system. The Normal EDR possesses inadequate capacity

Station (Reserve)
Power Capacity Analysis

NYCT Station MR Number	58
Station Name	Coney Island Stillwell / Surf Ave
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	112.0
Apparent Power (kVA)	140.0
Station Peak Demand Load, Max Current, (A)	388.9
Maximum Amount of Doors	320.0
PSD Total Load Including All Miscellaneous Loads, (A)	632.6
Total Load (Station Peak + PSD), (A)	1022
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	179
Is Electrical Service Adequate?	Yes
Notes	This is for Reserve service only. This is based on assumption that each Service is separate.Reserve service has spare capacity. (Normal service has **NO** spare capacity). See Analysis (N) tab.

Table 1. MRN 058 Reserve Capacity Analysis

Station (Normal)
Power Capacity Analysis

NYCT Station MR Number	58
Station Name	Coney Island Stillwell / Surf Ave
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	552.0
Apparent Power (kVA)	690.0
Station Peak Demand Load, Max Current, (A)	1916.7
Maximum Amount of Doors	320.0
PSD Total Load Including All Miscellaneous Loads, (A)	632.6
Total Load (Station Peak + PSD), (A)	2549
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	0
Is Electrical Service Adequate?	**No**
Notes	This is for Normal service only. Station has (2) separate meter readings (not combined). Normal service has exceeded its service rating. **NO** additional load be connected to this normal service. See Analysis (R) tab.

Table 1. MRN 058 Normal Capacity Analysis

Historic Restrictions:
None.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached

ROM estimate. The total cost for this station (only the F-line platform edges and equipment room) is estimated to be $32.2M to install APGs and $41.0M to install PSDs (See Appendix E).

:


Figure 3 – Typical platform edge condition with line of potential supplementary framing- Coney Island-Stillwell Avenue Station

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*
>
> a. *Column location in relation to the platform edge*
> b. *Platform edge clearance adjacent to stairs and other impediments*
> c. *Impacts to ADA path of travel and boarding areas*
> d. *Conflicts of PSD/APG/RPSDs with Signals cables*
> e. *Sufficient platform width*
> f. *Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*
>
> a. *Structural capacity of platforms to accept PSD/APG/RPSDs*
> b. *Feasibility & location for PSD/APG/RPSDs equipment room*
> c. *Confirmation of adequate power for PSD/APG/RPSDs*
> d. *Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> e. *Determination of communications requirements, availability and cost*
> f. *Determination of gap detection and entrapment avoidance technology requirements*
> g. *Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
   - Double the amount of motors as PSDs (each motor operating a single leaf).
   - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
   - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
   - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

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If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

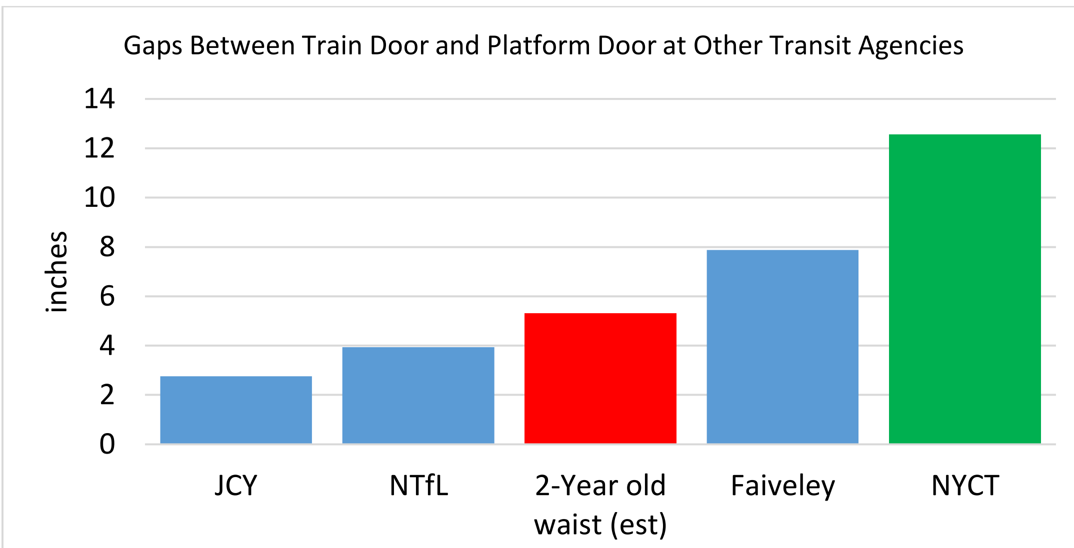


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

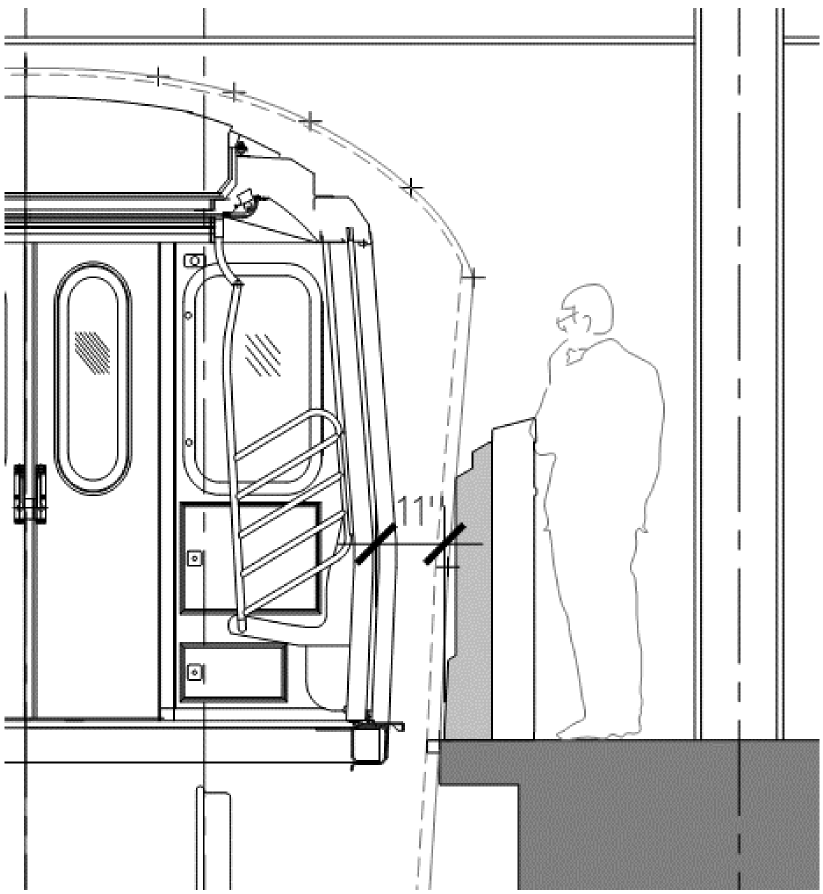


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber "bumpers" on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6" into the line equipment envelope. This would leave a 5" gap between the platform and car doors allowing approximately 2" of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5" by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor's window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor's window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **bold/underline**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	PSD System 1	PSD System 2	PSD System 3
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are "existing" as defined by code. All the rolling stock is also to be considered "existing" under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60" radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36" of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

304 Turning Space

304.1 General. Turning space shall comply with 304.

304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.

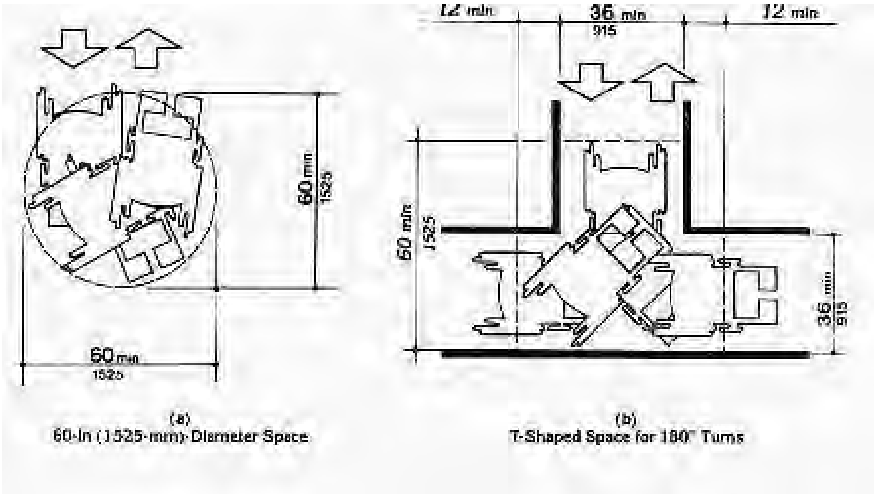
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

> *Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.*

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36” which may be constricted to 32” at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

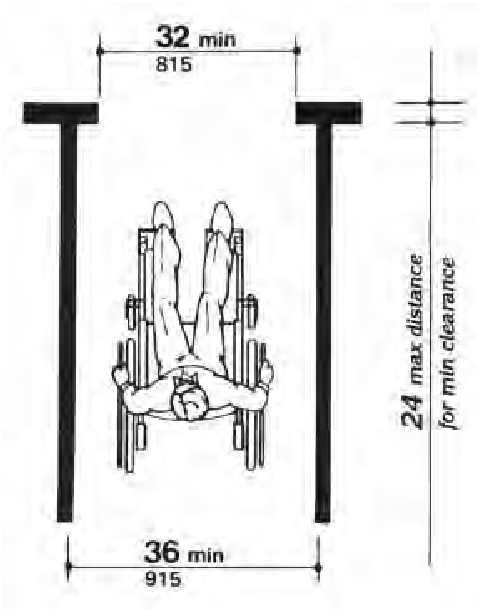


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

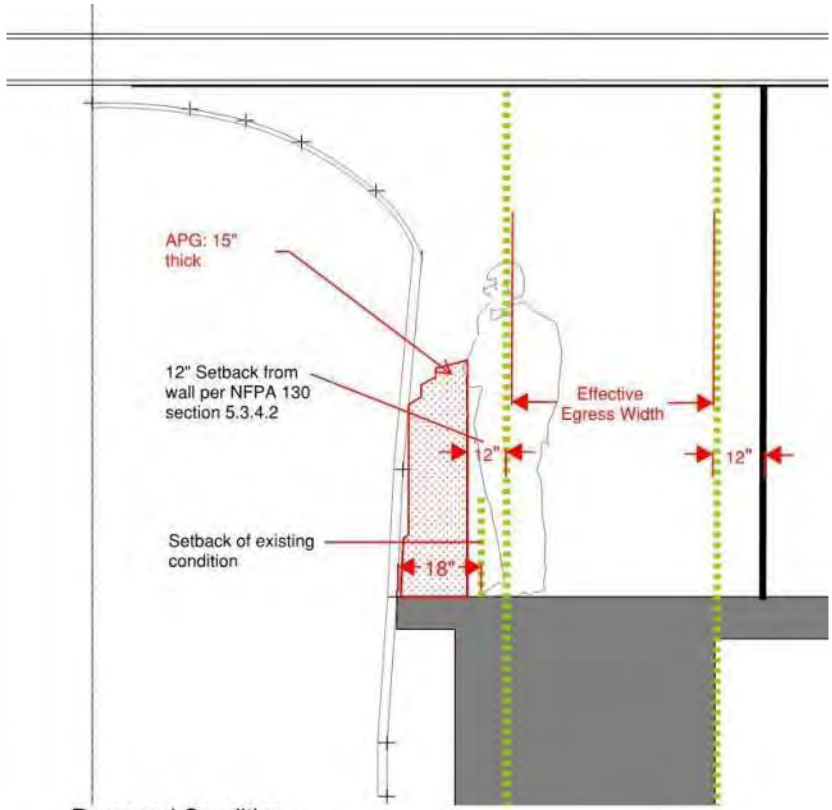
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15" of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

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Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			$2,961,912		$3,335,028		$732,000
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		$2,961,912		$4,335,028		$12,332,000

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

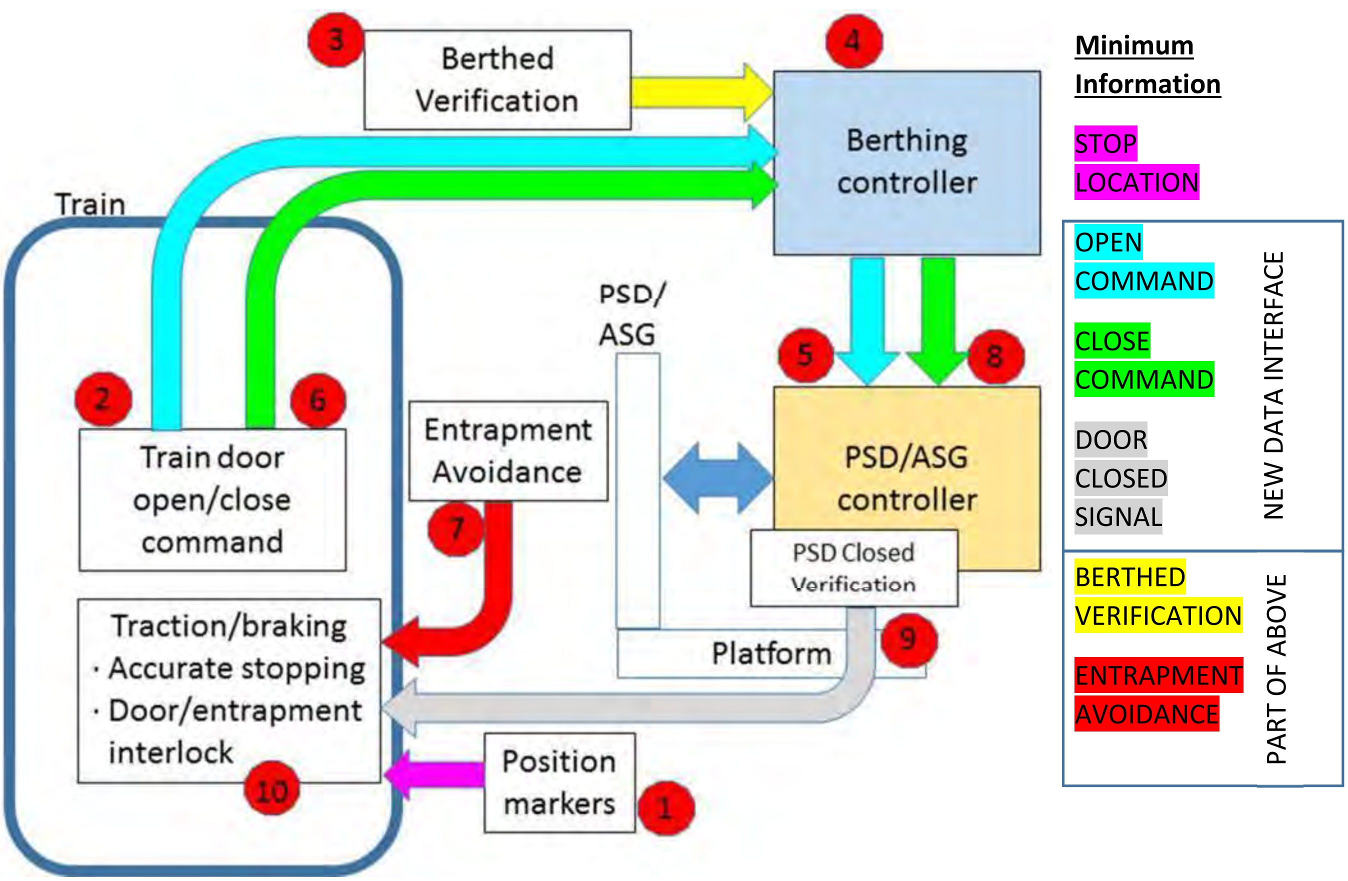
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

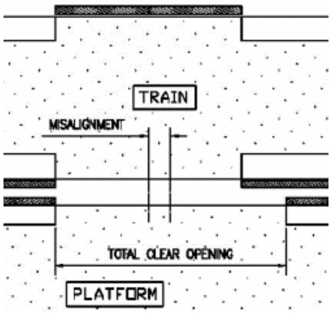
C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5" clear opening, a design for NY should meet the ADA Accessibility Guideline of 36".

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a 'distance totem' which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy's COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

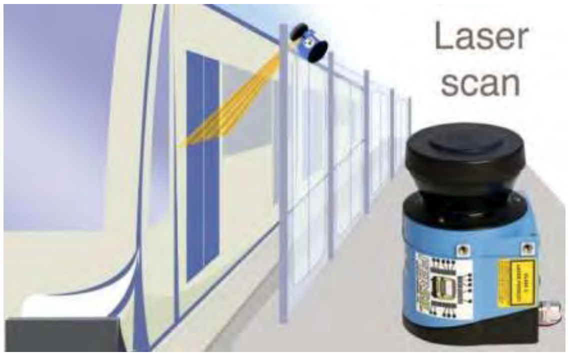
Dedicated Loop

The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically



If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.

For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4’-0”). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

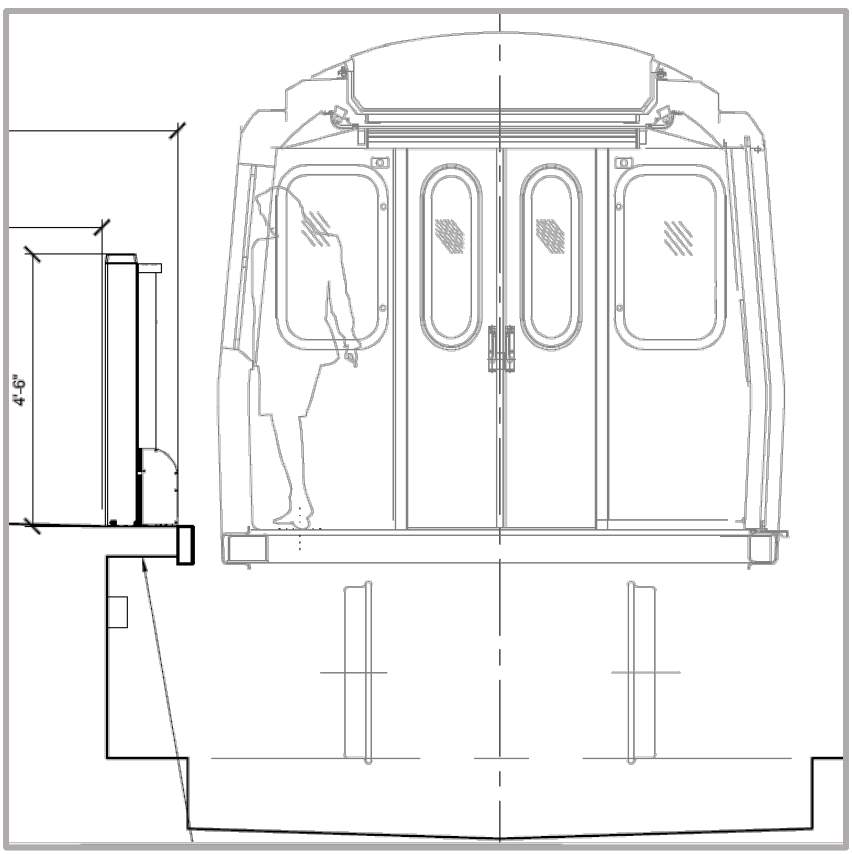


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the “wind” load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1” thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

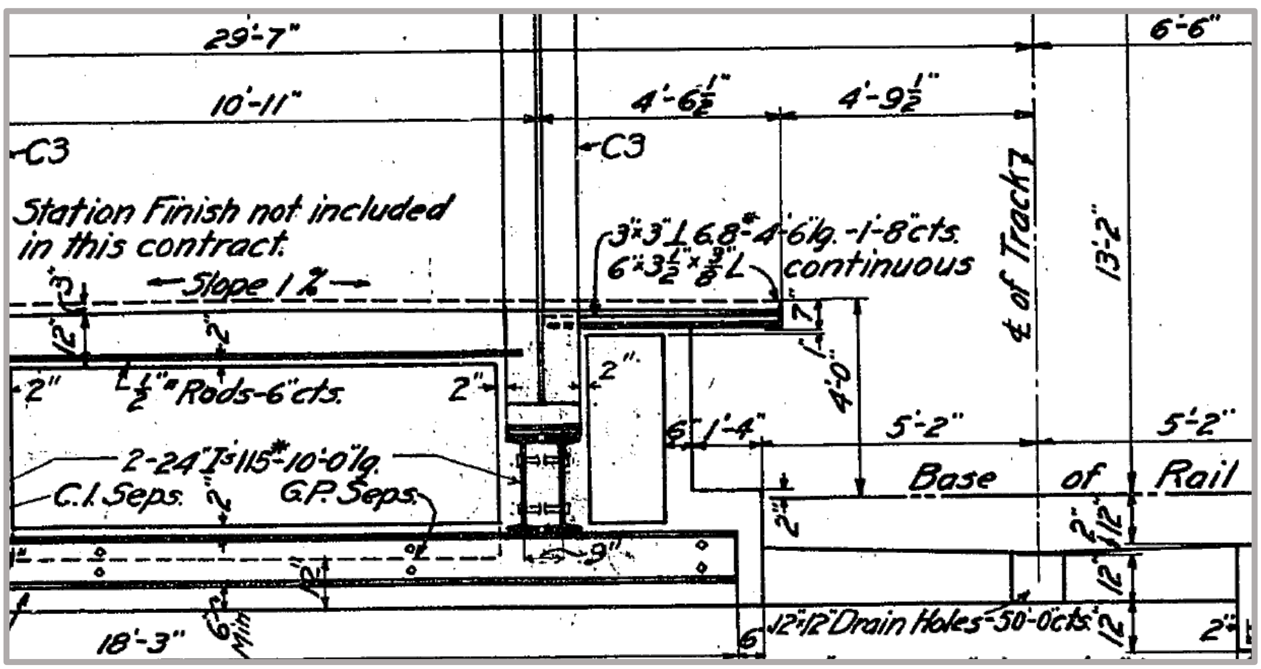


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6” thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1’-2” long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

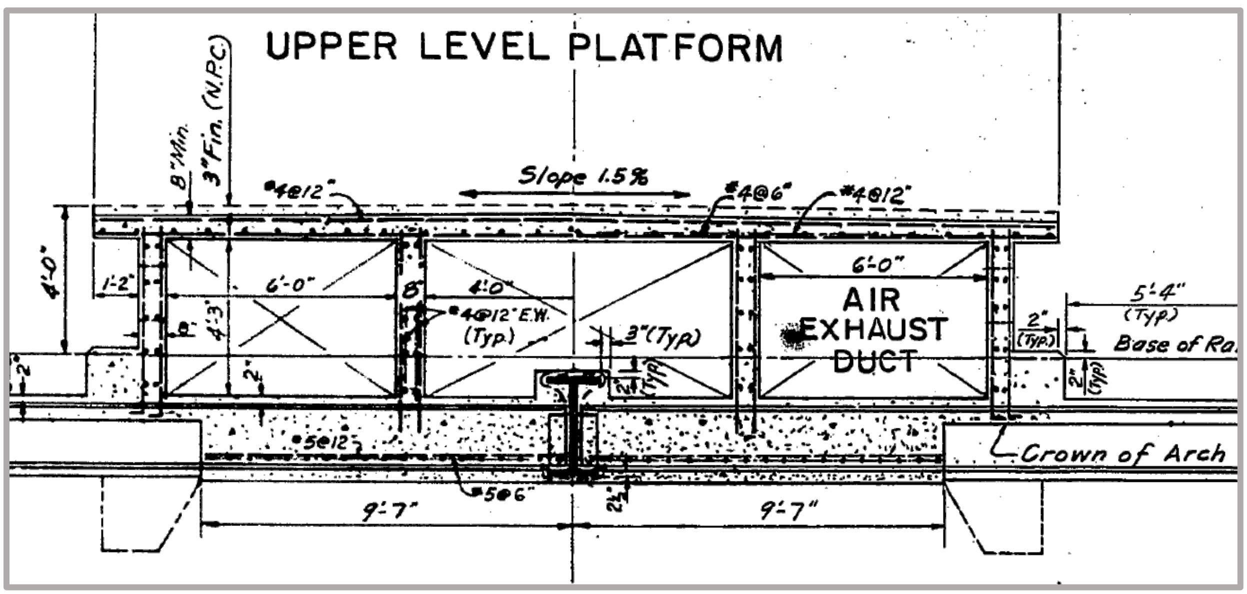


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; “E”, “J”, and “Z” trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

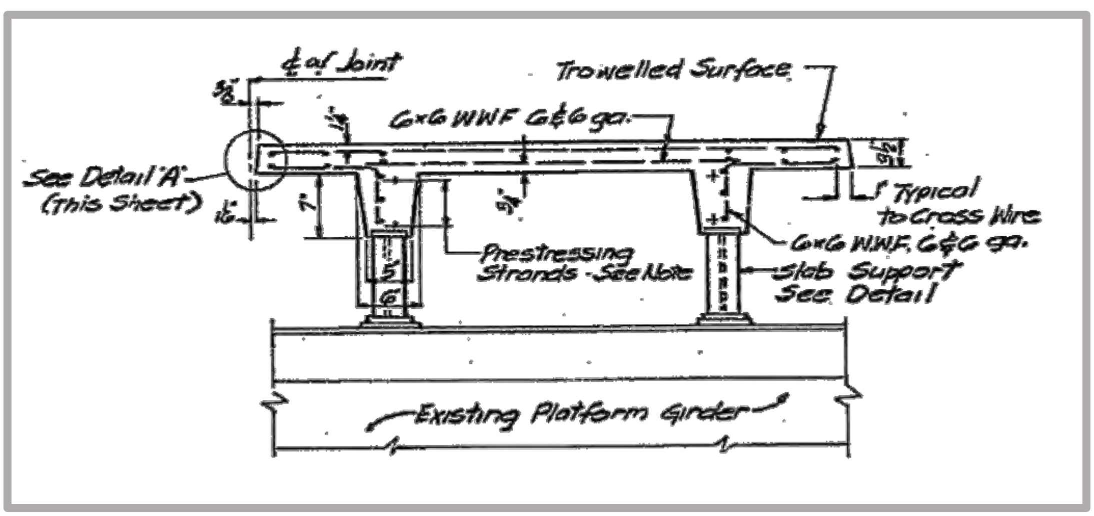


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

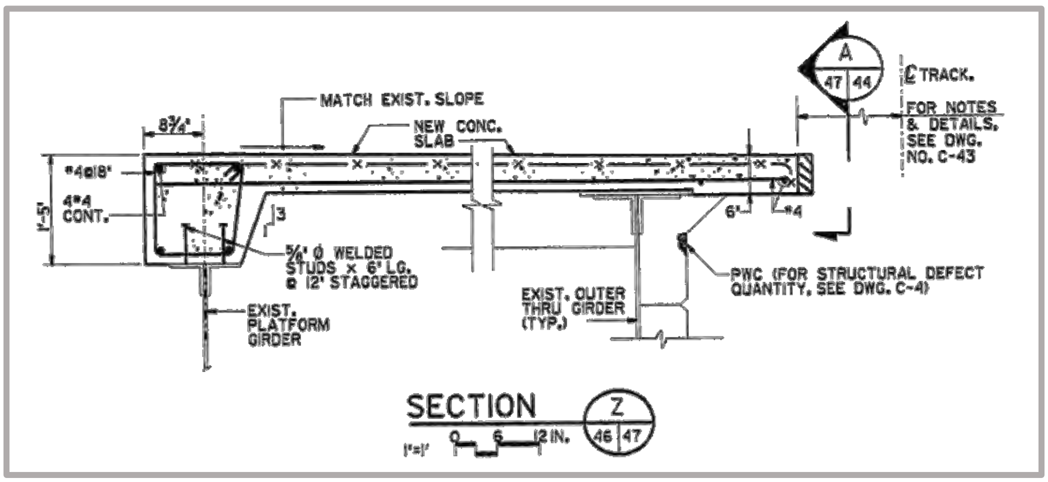


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2'-9"), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

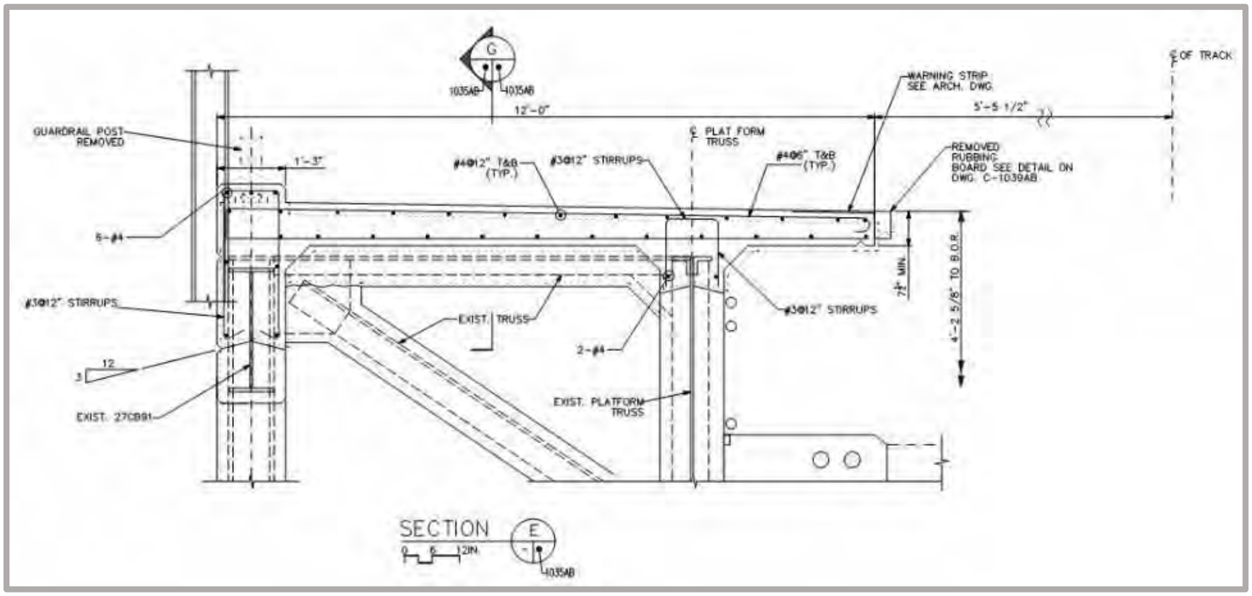


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3" thick structural slab with an approximately 3" thick topping slab. If the topping slab is fully removed, a 6" thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6" thick slab will be sufficient for a cantilever length of up to approximately 3'-0", greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6" structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6" minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

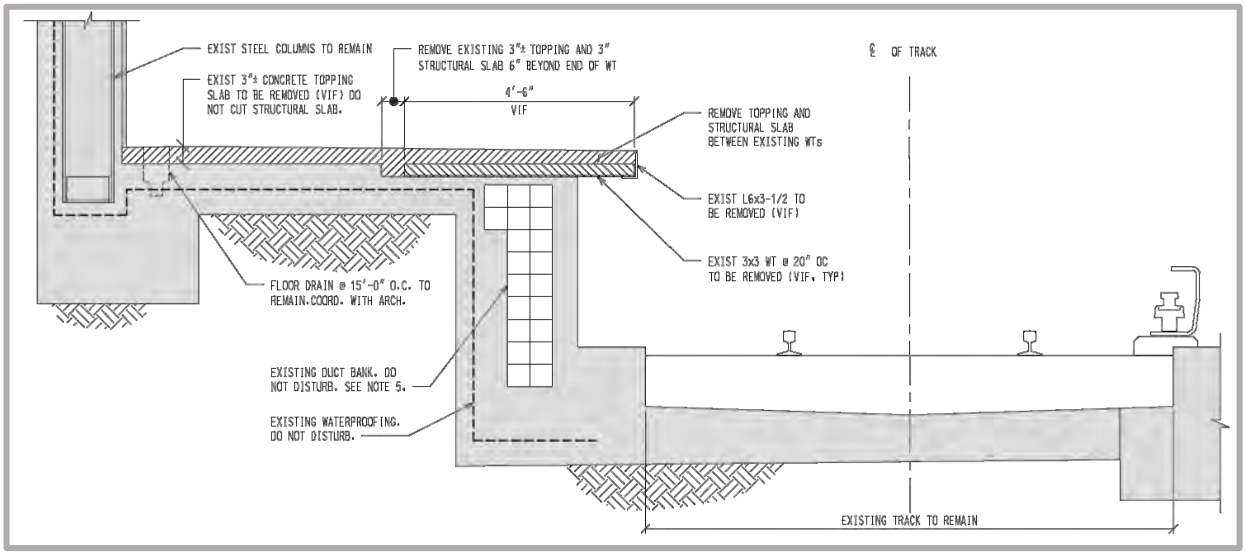


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

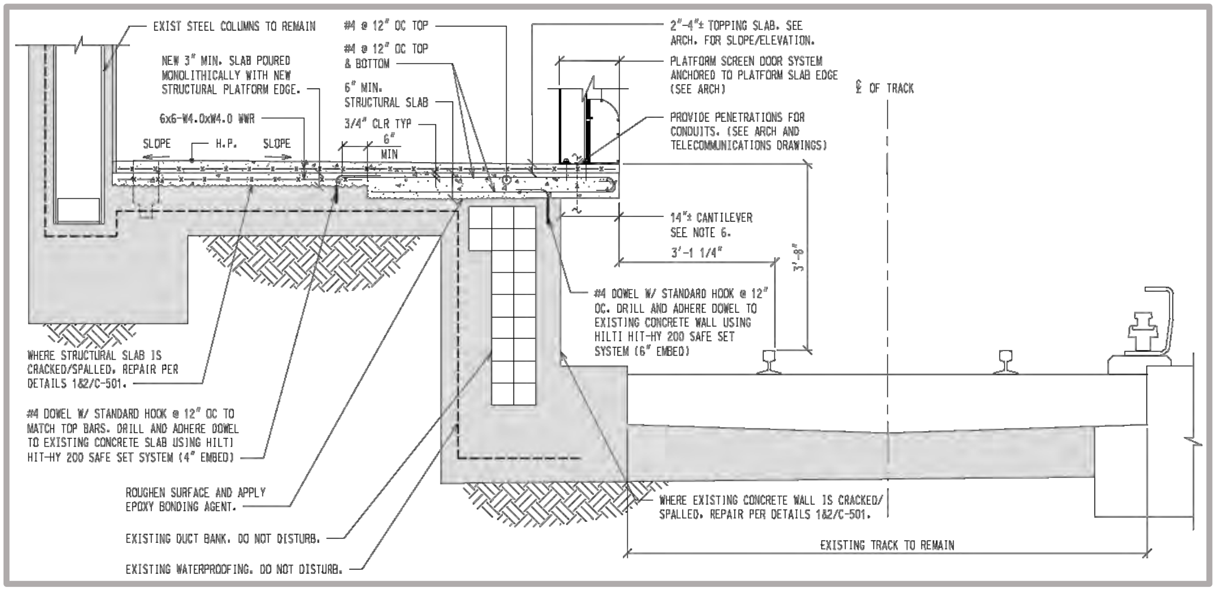


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

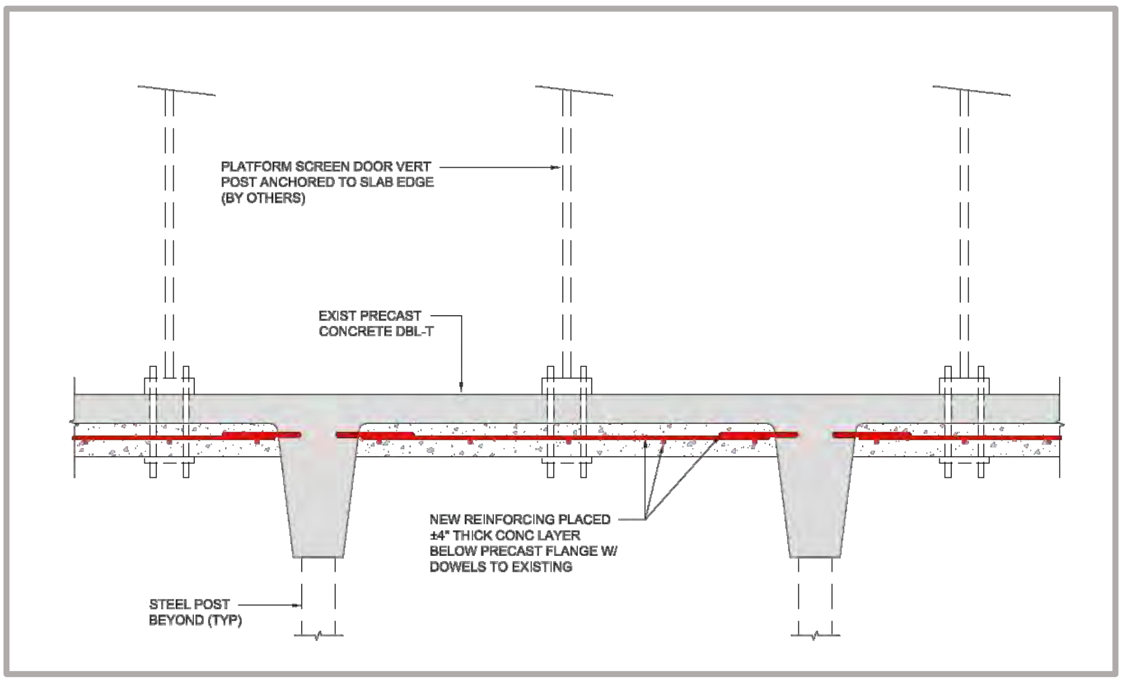


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5' – 11" of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis

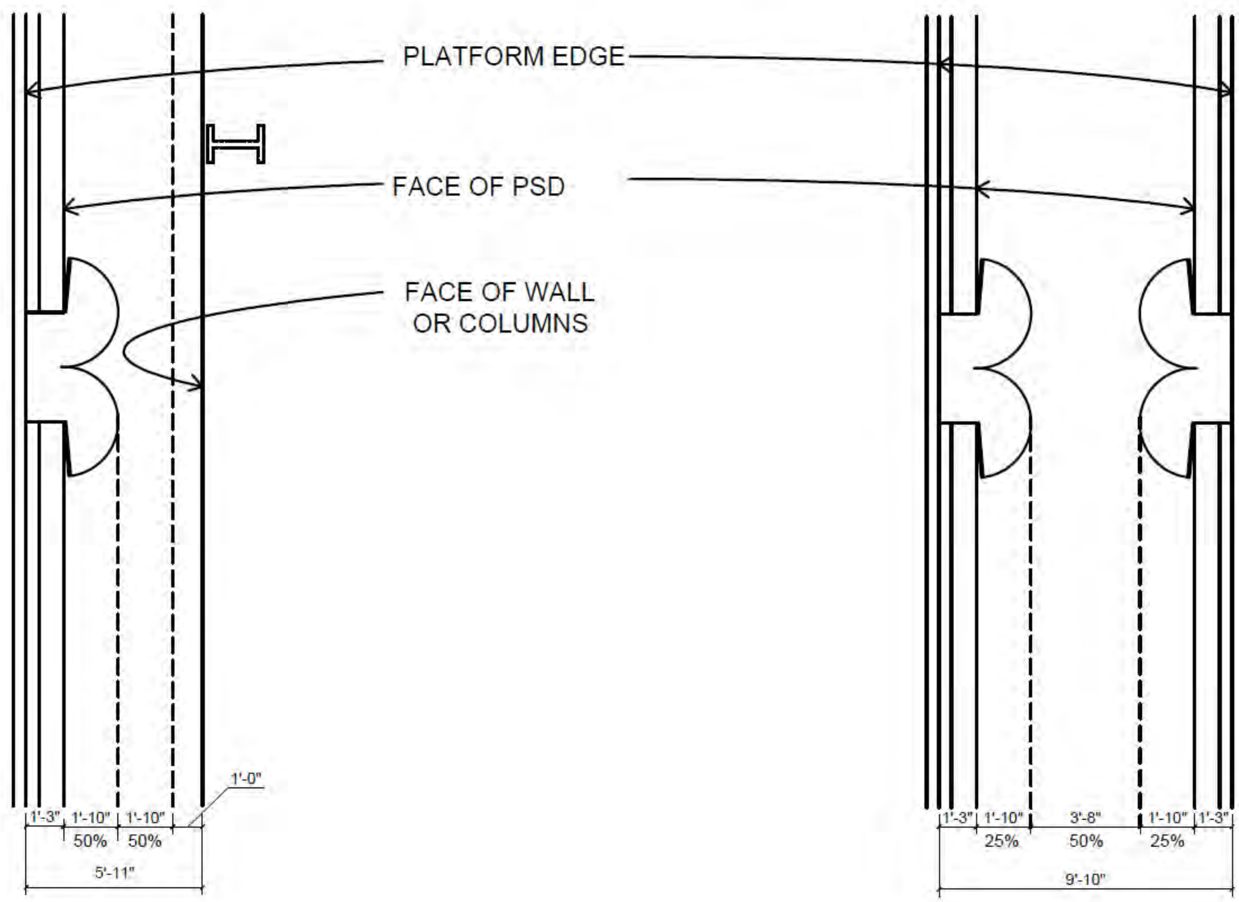


FIGURE 1: SIDE PLATFORM

FIGURE 2: CENTER PLATFORM

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

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MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the	9	$ 63,500 per month [Year 01]	$ 571,500		
	platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance	12	$ 83,590 per month [Year 02]	$ 1,003,080		
	since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for	12	$ 65,683 per month [Year 03]	$ 788,196		
	the System or some of its components, price should not include items covered by warranty.				$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
	remedial repair performed as needed, 24/7, for the	12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
	platform screen door system and ancillary equipment.					
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663

	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663

7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *	
		Year 3	$ 257 per hour *	
	Optional :	Year 4	$ 268 per hour *	
	Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations
ESTIMATE DATE:	October 4, 2018

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

MTA/NYCT

October 4, 2018

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs / PSDs will provide 39 emergency egress doors with push bars per platform*
1.2 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.3 *Each platform edge will have 50 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10” x 10” H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.2 In respect of the PSD option, only platforms that have not been upgraded in the recent past (assuming over the past two decades) will require platform edge replacement.
2.3 There are no special security requirements made necessary by installation of the APG system
2.4 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.5 This estimate does not provide for the replacement of Platform Edge Lighting
2.6 Premium cost for night time work is considered 50% of total labor cost

3.0 ***Exclusions - Costs not included in the estimate:***

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VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

MTA/NYCT

October 4, 2018

BASIS OF ESTIMATE

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems

3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length

3.4 Costs associated with NYCT State Of Good Repair improvements to the station

3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.

3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs

3.7 Escalation Cost is not included; Anticipate at 5% per annum.

3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.

3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium

3.10 NYCT project cost is not included

3.11 GO and flagging cost is not included

3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or "soft" costs:***

4.1 Design and Construction Contingency

4.2 Contractor O & P

4.3 Insurance

4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 *Given the limited time available, no drawings were developed to support this estimate.*

MTA /NYCT

October 4, 2018

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations
IRT Flushing Line Stations

	ORDER OF MAGNITUDE COSTS		MR-221	MR-222	MR-223	MR-235	MR-255
	DESCRIPTION		21ST ST. - QUEENSBRIDGE	ROOSEVELT ISLAND	LEXINGTON AVE - 63RD ST.	YORK ST.	STILLWELL AVE - CONEY ISLAND
1	AUTOMATIC PLATFORM GATES (APG'S)		$16,639,268	$16,706,054	$16,732,028	$17,238,933	$17,058,603
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$16,639,268	$16,706,054	$16,732,028	$17,238,933	$17,058,603
4	GENERAL REQUIREMENTS	15.00%	$2,495,890	$2,505,908	$2,509,804	$2,585,840	$2,558,790
	SUB-TOTAL:		$19,135,158	$19,211,962	$19,241,832	$19,824,773	$19,617,393
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,783,790	$4,802,991	$4,810,458	$4,956,193	$4,904,348
	SUB-TOTAL:		$23,918,948	$24,014,953	$24,052,291	$24,780,967	$24,521,741
6	OVERHEAD & PROFIT	15.00%	$3,587,842	$3,602,243	$3,607,844	$3,717,145	$3,678,261
	SUB-TOTAL:		$27,506,790	$27,617,196	$27,660,134	$28,498,112	$28,200,002
7	BONDS & INSURANCE	3.75%	$1,031,505	$1,035,645	$1,037,255	$1,068,679	$1,057,500
	SUB-TOTAL:		$28,538,295	$28,652,841	$28,697,389	$29,566,791	$29,257,502
	SUB-TOTAL:		$28,538,295	$28,652,841	$28,697,389	$29,566,791	$29,257,502
	SUBTOTAL CONSTRUCTION COST W/O ACM		**$28,538,295**	**$28,652,841**	**$28,697,389**	**$29,566,791**	**$29,257,502**
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		**$28,538,295**	**$28,652,841**	**$28,697,389**	**$29,566,791**	**$29,257,502**
10	DESIGN CONSULTANT FEES	10.00%	$2,853,829	$2,865,284	$2,869,739	$2,956,679	$2,925,750
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST		**$31,392,124**	**$31,518,125**	**$31,567,128**	**$32,523,470**	**$32,183,253**

	ADD ALTERNATIVES						
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		4,445,722	4,908,488	4,059,284	4,603,823	4,682,415
	Add for Markups (as above)	88.66%	3,941,705	4,352,007	3,599,078	4,081,883	4,151,564
			$8,387,427	**$9,260,496**	**$7,658,362**	**$8,685,706**	**$8,833,979**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: 21ST STREET - QUEENSBRIDGE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	607	LF		
5	LENGTH OF THE PLATFORM EDGE [QUEENS BOUND] =	615	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,222**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,222	LF	7	8,554
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,110	SF	12	73,320
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	123	CY	2,500	307,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,224	EA	25	30,600
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,224	EA	25	30,600
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,222	LF	95	116,090
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,222	LF	15	18,330
26	Remove existing platform tiles	1,222	LF	12	14,664
27	Sawcut existing topping concrete at perimeter of removal area	1,222	LF	5	6,110
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,332	SF	8	58,656
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 12'-6" wide strip	572	SF	8	4,576
30	New Work				
31	New concrete topping to match existing	1,222	SF	15	18,330
32	New concrete topping at ADA boarding area to match existing	572	SF	15	8,580

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: 21ST STREET - QUEENSBRIDGE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	410	SF	5	2,050
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,214	SF	750	1,660,500
61	Spare Parts - Approx. 10% of Material Cost	1	LS	226,290	226,290
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
71	Allow for conduit / cable runs for power and communications under platform edge	1,222	LF	60	73,320

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: 21ST STREET - QUEENSBRIDGE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
74	Power to PSD Room from EDR including track crossing if needed	250	LF	60	15,000
75	Reserve power to PSD Room from EDR including track crossing if needed	750	LF	60	45,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
79	MISC				
80	Testing and commissioning	1	LS	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	2,000	Hrs	160	319,860
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: 21ST STREET - QUEENSBRIDGE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,839,831	3,839,831
113	**TOTAL PSD WORK:**				**$ 16,639,268**

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
115					
116	**ADD ALTERNATIVE**				
117					
118	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
119					
120	**ADD**				
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,910	SF	750	3,682,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	419,062	419,062
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,135
129	L6x6x1/2 continuous angle	9	TONS	17,500	157,394
130	Drilling and bolting - 4 bolts at each connection	489	EA	216	105,581
131	Extra Structure frame at locations with different ceiling height; Approx. 100' long	1	LS	300,000	300,000
132	Platform Edge Repair - **Not Required**				
133	Remove concrete platform edge	-	LF	27	-
134	Platform edge repair	-	LF	109	-
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	-	EA	10	-
136					
137	**OMIT**				
138	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
139	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
140	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
141	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: 21ST STREET - QUEENSBRIDGE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Fixed Panels including framing and support; 4'-6" High	(2,214)	SF	750	(1,660,500)
143	Spare Parts - Approx. 10% of Material Cost	(1)	LS	226,290	(226,290)
144	Platform Edge Reconstruction work	(1)	LS	557,220	(557,220)
145	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
146	Conduit running under Platform Edge	(1,222)	LF	30	(36,660)
147					
148	Allow loss of production to work at night say 50%	1	LS	1,025,936	1,025,936
149					
150	**PREMIUM ASSOCIATED WITH PSD's**				**4,445,722**

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: ROOSEVELT ISLAND

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	615	LF		
5	LENGTH OF THE PLATFORM EDGE [QUEENS BOUND] =	615	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,230**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,230	LF	7	8,610
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,150	SF	12	73,800
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,232	EA	25	30,800
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,232	EA	25	30,800
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,230	LF	95	116,850
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,230	LF	15	18,450
26	Remove existing platform tiles	1,230	LF	12	14,760
27	Sawcut existing topping concrete at perimeter of removal area	1,230	LF	5	6,150
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,380	SF	8	59,040
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 12' wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,230	SF	15	18,450
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: ROOSEVELT ISLAND

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Fire rated door including frame & hardware	1	EA	2,500	2,500
42	Exterior wall finish				
43	Ceramic Tiling to match existing	410	SF	40	16,400
44	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
45	Concrete cove to match existing	41	LF	20	820
46	Interior Wall Finish - Paint	410	SF	5	2,050
47	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
48	Allow for 4" thick concrete pads for equipment	47	SF	20	945
49	Allowance for Mechanical Scope	1	LS	40,000	40,000
50	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
51	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
52	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
53					
54	**Automatic Platform Gates [APGs] - 4'-6" High**				
55	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
56	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
57	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
58	Platform End Gates (PEGs)	4	EA	13,000	52,000
59	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
60	Spare Parts - Approx. 10% of Material Cost	1	LS	227,910	227,910
61	Testing and commissioning	800	HRS	160	127,944
62	Product Warranty	1	LS	1,000,000	1,000,000
63	Allowance for Braille Signage	80	EA	2,500	200,000
64					
65	**Electrical**				
66	Electrical Upgrades				
67	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
68	Power and Lighting				
69	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
70	Allow for conduit / cable runs for power and communications under platform edge	1,230	LF	60	73,800

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: ROOSEVELT ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	PSD Connections	1	LS	75,000	75,000
72	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
73	Power to PSD Room from EDR including track crossing if needed	650	LF	60	39,000
74	Reserve power to PSD Room from EDR including track crossing if needed	750	LF	60	45,000
75	No allowance for new lighting as if APG's are used		Note		EXCL.
76	Grounding				
77	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
78	MISC				
79	Testing and commissioning	1	LS	30,000	30,000
80	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
81					
82	**Communications**				
83	FA System				
84	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
85	CCTV coverage				
86	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
87	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
88	Berthing Technology Sensors				
89	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
90	Train Door Detection System				
91	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
92	Entrapment concerns				
93	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
94	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
95	Engineering and Testing	2,000	Hrs	160	319,860
96	Centralized monitoring/control				
97	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
98	MISC				
99	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
100	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
101	Site Survey and Inspections	1	LS	100,000	100,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: ROOSEVELT ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
103	Furnish Test Equipment allowance	1	LS	500,000	500,000
104	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
105					
106	**Training**				
107	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
108					
109	**Out of hours Work**				
110	Allow loss of production to work at night say 50%	1	LS	3,855,243	3,855,243
111					
112	**TOTAL PSD WORK:**				**$ 16,706,054**

114					
115	**ADD ALTERNATIVE**				
116					
117	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
118					
119	**ADD**				
120	Relocate existing platform edge light fittings and lighting supports including modifying / extending existing circuits	1,230	LF	375	461,250
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,974	SF	750	3,730,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	421,942	421,942
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,657
129	L6x6x1/2 continuous angle	9	TONS	17,500	158,424
130	Drilling and bolting - 4 bolts at each connection	492	EA	216	106,272
131	Platform Edge Repair [Ambiguity on Drawing information]				
132	Remove concrete platform edge	1,230	LF	27	33,210
133	Platform edge repair	1,230	LF	109	134,070
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
135					
136	**OMIT**				
137	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: ROOSEVELT ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
141	Fixed Panels including framing and support; 4'-6" High	(2,250)	SF	750	(1,687,500)
142	Spare Parts - Approx. 10% of Material Cost	(1)	LS	227,910	(227,910)
143	Platform Edge Reconstruction work	(1)	LS	560,600	(560,600)
144	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
145	Conduit running under Platform Edge	(1,230)	LF	30	(36,900)
147	Allow loss of production to work at night say 50%	1	LS	1,132,728	1,132,728
148					
149					
150	**PREMIUM ASSOCIATED WITH PSD's**				**4,908,488**

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: LEXINGTON AVE - 63RD ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	615	LF		
5	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	615	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,230**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,230	LF	7	8,610
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,150	SF	12	73,800
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,232	EA	25	30,800
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,232	EA	25	30,800
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,230	LF	95	116,850
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,230	LF	15	18,450
26	Remove existing platform tiles	1,230	LF	12	14,760
27	Sawcut existing topping concrete at perimeter of removal area	1,230	LF	5	6,150
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,380	SF	8	59,040
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Platform width i.e. 21'-6" wide strip at ADA boarding area	418	SF	8	3,344
30	New Work				
31	New concrete topping to match existing	1,230	SF	15	18,450
32	New concrete topping at ADA boarding area to match existing	418	SF	15	6,270

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: LEXINGTON AVE - 63RD ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [12'-0" x 16'-0"]**				
37	Build off existing Mezzanine Slab; 3 Walls only		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	56	LF	90	5,040
39	CMU Wall for equipment room	560	SF	45	25,200
40	Vertical connections with existing structure	-	LF	25	-
41	Fire rated door including frame & hardware	1	EA	2,500	2,500
42	Exterior wall finish				
43	Ceramic Tiling to match existing	560	SF	40	22,400
44	Mosaic Band to match existing - Assuming 8" high	56	LF	120	6,720
45	Concrete cove to match existing	56	LF	20	1,120
46	Interior Wall Finish - Paint	560	SF	5	2,800
47	Allow for Misc. floor & ceiling finishes	192	SF	15	2,880
48	Allow for 4" thick concrete pads for equipment	48	SF	20	960
49	Allowance for Mechanical Scope	1	LS	40,000	40,000
50	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
51	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
52	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54	**Automatic Platform Gates [APGs] - 4'-6" High**				
55	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
56	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
57	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
58	Platform End Gates (PEGs)	4	EA	13,000	52,000
59	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
60	Spare Parts - Approx. 10% of Material Cost	1	LS	227,910	227,910
61	Testing and commissioning	800	HRS	160	127,944
62	Product Warranty	1	LS	1,000,000	1,000,000
63	Allowance for Braille Signage	80	EA	2,500	200,000
64					
65	**Electrical**				
66	Electrical Upgrades				
67	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
68	Power and Lighting				
69	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
70	Allow for conduit / cable runs for power and communications under platform edge	1,230	LF	60	73,800
	PSD Connections	1	LS	75,000	75,000

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STATION: LEXINGTON AVE - 63RD ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
72	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
73	Power to PSD Room from EDR including track crossing if needed	750	LF	60	45,000
74	Reserve power to PSD Room from EDR including track crossing if needed	750	LF	60	45,000
75	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
76	Grounding				
77	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
78	MISC				
79	Testing and commissioning	1	LS	30,000	30,000
80	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
81					
82	**Communications**				
83	FA System				
84	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
85	CCTV coverage				
86	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
87	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
88	Berthing Technology Sensors				
89	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
90	Train Door Detection System				
91	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
92	Entrapment concerns				
93	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
94	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
95	Engineering and Testing	2,000	Hrs	160	319,860
96	Centralized monitoring/control				
97	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
98	MISC				
99	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
100	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
101	Site Survey and Inspections	1	LS	100,000	100,000

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: LEXINGTON AVE - 63RD ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
102	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
103	Furnish Test Equipment allowance	1	LS	500,000	500,000
104	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
105					
106	**Training**				
107	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
108					
109	**Out of hours Work**				
110	Allow loss of production to work at night say 50%	1	LS	3,861,237	3,861,237
112	TOTAL PSD WORK:				$ 16,732,028

114					
115	ADD ALTERNATIVE				
116					
117	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
118					
119	ADD				
120	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
121	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
122	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
123	Platform End Gates (PEGs)	4	EA	18,000	72,000
124	Fixed Panels including framing and support; Assuming 8'-0" high	4,974	SF	750	3,730,365
125	Spare Parts - Approx. 10% of Material Cost	1	LS	421,942	421,942
126	Structual framing / bracing				
127	HSS4x4x1/2 hanger	5	TONS	17,500	81,657
128	L6x6x1/2 continuous angle	9	TONS	17,500	158,424
129	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
130	Platform Edge Repair - **Not Required**				
131	Remove concrete platform edge	-	LF	27	-
132	Platform edge repair	-	LF	109	-
133	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	-	EA	10	-
134					
135	OMIT				
136	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
137	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
138	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
139	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
140	Fixed Panels including framing and support; 4'-6" High	(2,250)	SF	750	(1,687,500)
141	Spare Parts - Approx. 10% of Material Cost	(1)	LS	227,910	(227,910)

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: LEXINGTON AVE - 63RD ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Platform Edge Reconstruction work	(1)	LS	560,600	(560,600)
143	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
144	Conduit running under Platform Edge	(1,230)	LF	30	(36,900)
145					
146	Allow loss of production to work at night say 50%	1	LS	936,758	936,758
147					
148	**PREMIUM ASSOCIATED WITH PSD's**				**4,059,284**

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: YORK ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	660	LF		
5	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,320**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Platform width i.e. 20'-0" wide strip at ADA boarding area	352	SF	8	2,816
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800
32	New concrete topping at ADA boarding area to match existing	352	SF	15	5,280

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: YORK ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [12'-0" x 16'-0"]**				
37	Build off existing Paid Area Slab; 3 Walls only		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	44	LF	90	3,960
39	CMU Wall for equipment room	440	SF	45	19,800
40	Vertical connections with existing structure	20	LF	25	500
41	Fire rated door including frame & hardware	1	EA	2,500	2,500
42	Exterior wall finish				
43	Ceramic Tiling to match existing	440	SF	40	17,600
44	Mosaic Band to match existing - Assuming 8" high	44	LF	120	5,280
45	Concrete cove to match existing	44	LF	20	880
46	Interior Wall Finish - Paint	440	SF	5	2,200
47	Allow for Misc. floor & ceiling finishes	192	SF	15	2,880
48	Allow for 4" thick concrete pads for equipment	48	SF	20	960
49	Allowance for Mechanical Scope	1	LS	40,000	40,000
50	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
51	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
52	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
53					
54	**Automatic Platform Gates [APGs] - 4'-6" High**				
55	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
56	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
57	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
58	Platform End Gates (PEGs)	4	EA	13,000	52,000
59	Fixed Panels including framing and support; 4'-6" High	2,655	SF	750	1,991,250
60	Spare Parts - Approx. 10% of Material Cost	1	LS	246,135	246,135
61	Testing and commissioning	800	HRS	160	127,944
62	Product Warranty	1	LS	1,000,000	1,000,000
63	Allowance for Braille Signage	80	EA	2,500	200,000
64					
65	**Electrical**				
66	Electrical Upgrades				
67	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
68	Power and Lighting				
69	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
70	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: YORK ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
	PSD Connections	1	LS	75,000	75,000
72	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
73	Power to PSD Room from EDR including track crossing if needed	950	LF	60	57,000
74	Reserve power to PSD Room from EDR including track crossing if needed	1,000	LF	60	60,000
75	No allowance for new lighting as if APG's are used		Note		EXCL.
76	Grounding				
77	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
78	MISC				
79	Testing and commissioning	1	LS	30,000	30,000
80	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
81					
82	**Communications**				
83	FA System				
84	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
85	CCTV coverage				
86	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
87	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
88	Berthing Technology Sensors				
89	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
90	Train Door Detection System				
91	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
92	Entrapment concerns				
93	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
94	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
95	Engineering and Testing	2,000	Hrs	160	319,860
96	Centralized monitoring/control				
97	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
98	MISC				
99	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
100	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
101	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: YORK ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
103	Furnish Test Equipment allowance	1	LS	500,000	500,000
104	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
105					
106	**Training**				
107	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
108					
109	**Out of hours Work**				
110	Allow loss of production to work at night say 50%	1	LS	3,978,215	3,978,215
112	TOTAL PSD WORK:				$ 17,238,933

114					
115	ADD ALTERNATIVE				
116					
117	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
118					
119	ADD				
120	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
121	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
122	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
123	Platform End Gates (PEGs)	4	EA	18,000	72,000
124	Fixed Panels including framing and support; Assuming 8'-0" high	5,694	SF	750	4,270,365
125	Spare Parts - Approx. 10% of Material Cost	1	LS	454,342	454,342
126	Structual framing / bracing				
127	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
128	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
129	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
130	Platform Edge Repair				
131	Remove concrete platform edge	1,320	LF	27	35,640
132	Platform edge repair	1,320	LF	109	143,880
133	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
134					
135	OMIT				
136	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
137	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
138	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
139	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
140	Fixed Panels including framing and support; 4'-6" High	(2,655)	SF	750	(1,991,250)
141	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,135	(246,135)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: YORK ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Platform Edge Reconstruction work	(1)	LS	593,000	(593,000)
143	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
144	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
145					
146	Allow loss of production to work at night say 50%	1	LS	1,062,421	1,062,421
147					
148	**PREMIUM ASSOCIATED WITH PSD's**				**4,603,823**

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: STILLWELL AVE - CONEY ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [TRACK 5] =	640	LF		
5	LENGTH OF THE PLATFORM EDGE [TRACK 6] =	640	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,280**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,280	LF	7	8,960
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,400	SF	12	76,800
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	129	CY	2,500	322,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,282	EA	25	32,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,282	EA	25	32,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,280	LF	95	121,600
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,280	LF	15	19,200
26	Remove existing platform tiles	1,280	LF	12	15,360
27	Sawcut existing topping concrete at perimeter of removal area	1,280	LF	5	6,400
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,680	SF	8	61,440
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Platform width i.e. 27'-0" wide strip at ADA boarding area	660	SF	8	5,280
30	New Work				
31	New concrete topping to match existing	1,280	SF	15	19,200
32	New concrete topping at ADA boarding area to match existing	660	SF	15	9,900

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: STILLWELL AVE - CONEY ISLAND

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [12'-0" x 16'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	56	LF	90	5,040
39	CMU Wall for equipment room	560	SF	45	25,200
40	Vertical connections with existing structure	-	LF	25	-
41	Roof				-
42	Structural Steel Roof Framing; say 15 lbs / sf	2	TONS	17,500	35,000
43	New standing seam roof sheeting	192	SF	38	
44	Roof gutters and down spout	16	LF	40	640
45	Powder Coated Aluminum Parapet Flashing	56	LF	45	2,520
46	Fire rated door including frame & hardware	1	EA	2,500	2,500
47	Exterior wall finish				-
48	Metal cladding to exterior	560	SF	50	28,000
49	Interior Wall Finish - Paint	560	SF	5	2,800
50	Allow for Misc. floor & ceiling finishes	192	SF	15	2,880
51	Allow for 4" thick concrete pads for equipment	48	SF	20	960
52	Allowance for Mechanical Scope	1	LS	40,000	40,000
53	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
54	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
55	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
56					
57	**Automatic Platform Gates [APGs] - 4'-6" High**				
58	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
59	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
60	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
61	Platform End Gates (PEGs)	4	EA	13,000	52,000
62	Fixed Panels including framing and support; 4'-6" High	2,475	SF	750	1,856,250
63	Spare Parts - Approx. 10% of Material Cost	1	LS	238,035	238,035
64	Testing and commissioning	800	HRS	160	127,944
65	Product Warranty	1	LS	1,000,000	1,000,000
66	Allowance for Braille Signage	80	EA	2,500	200,000
67					
68	**Electrical**				
69	Electrical Upgrades				
70	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
71	Power and Lighting				
72	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: STILLWELL AVE - CONEY ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
73	Allow for conduit / cable runs for power and communications under platform edge	1,280	LF	60	76,800
	PSD Connections	1	LS	75,000	75,000
75	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
76	Power to PSD Rooms from EDR [Conduit & Cable]	750	LF	60	45,000
77	Reserve power to PSD Room from EDR [Conduit & Cable]	750	LF	60	45,000
78	No allowance for new lighting as if APG's are used		Note		EXCL.
79	Grounding				
80	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
81	MISC				
82	Testing and commissioning	1	LS	30,000	30,000
83	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
84					
85	**Communications**				
86	FA System				
87	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
88	CCTV coverage				
89	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
90	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
91	Berthing Technology Sensors				
92	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
93	Train Door Detection System				
94	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
95	Entrapment concerns				
96	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
97	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
98	Engineering and Testing	2,000	Hrs	160	319,860
99	Centralized monitoring/control				
100	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
101	MISC				
102	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
103	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
104	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: STILLWELL AVE - CONEY ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
105	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
106	Furnish Test Equipment allowance	1	LS	500,000	500,000
107	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
108					
109	Training				
110	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
111					
112	Out of hours Work				
113	Allow loss of production to work at night say 50%	1	LS	3,936,601	3,936,601
115	TOTAL PSD WORK:				$ 17,058,603

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
117					
118	ADD ALTERNATIVE				
119					
120	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
121					
122	ADD				
123	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
124	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
125	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
126	Platform End Gates (PEGs)	4	EA	18,000	72,000
127	Fixed Panels including framing and support; Assuming 8'-0" high	5,374	SF	750	4,030,365
128	Spare Parts - Approx. 10% of Material Cost	1	LS	439,942	439,942
129	Structual framing / bracing				
130	HSS4x4x1/2 hanger	5	TONS	17,500	84,923
131	L6x6x1/2 continuous angle	9	TONS	17,500	164,864
132	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
133	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long	1	LS	350,000	350,000
134	Platform Edge Repair - **Not Required**				
135	Remove concrete platform edge	-	LF	27	-
136	Platform edge repair	-	LF	109	-
137	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	-	EA	10	-
138					
139	OMIT				
140	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
141	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
142	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
143	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: STILLWELL AVE - CONEY ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144	Fixed Panels including framing and support; 4'-6" High	(2,475)	SF	750	(1,856,250)
145	Spare Parts - Approx. 10% of Material Cost	(1)	LS	238,035	(238,035)
146	Platform Edge Reconstruction work	(1)	LS	578,600	(578,600)
147	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
148	Conduit running under Platform Edge	(1,280)	LF	30	(38,400)
149					
150	Allow loss of production to work at night say 50%	1	LS	1,080,557	1,080,557
151					
152					
153	**PREMIUM ASSOCIATED WITH PSD's**				**4,682,415**

New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR ‘B’ SERVICE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

FINAL SUBMITTAL DATE: June 3, 2019

STV 100 Years

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Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. Our Tier 1 analysis found no instances of door misalignment between car classes for this line. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 37 newly evaluated stations, 31 have been found to be not suitable for the installation of PSDs.

[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to half-height barriers]

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues: the platform edge barriers are 15" wide. Where an existing object (wall, stair, and railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Under the following conditions, PSDs are declared infeasible:
  - Limit the ability of a wheelchair to turn within a 5'-0" circle
  - Limit path of travel to less than a 32" pinch width (defined as an obstruction that measures less than 2'-0" longitudinally, i.e. columns)
  - Limit path of travel to be less than a 36" corridor as defined by the edge of a staircase, railing or room
- Insufficient space for the PSD equipment room: the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow: due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements regarding the placement of these new barriers in an existing station environment.
- Structural considerations: existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.

- Columns at platform edge: at certain stations, the columns are positioned 16" to 24" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space.

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the previously proposed 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the PSD barriers and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is used for refuse removal at most of the B-line stations. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the (off) loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in damage from these carts along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process.

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 16% of the 'B' Line Stations. Total implementation cost would be \$189.4M for APGs and \$242.7M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; that estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of \$931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 6 feasible stations, the aggregate annual maintenance cost would be \$5.6M.

Summary Table

(16% Feasible 6/37)

MRN No.	Station Names	Station Type	Platform Type	Feasibility	Issues/Reason for Failure	Cost APGs	Cost PSDs
026	Dekalb Avenue	SUB	Island	No	ADA Clearance		
040	Atlantic Ave. Barclays Ctr.	SUB	Island	No	ADA Clearance	-	-
041	7th Avenue (Brooklyn)	SUB	Side	No	Columns too close to edge	-	-
042	Prospect Park	CUT	Island	No	ADA Clearance	-	-
044	Church Avenue	CUT	Island	No	ADA Clearance	-	-
047	Newkirk Plaza	CUT	Island	No	ADA Clearance	-	-
051	Kings Highway	EMB	Island	No	ADA Clearance	-	-
054	Sheepshead Bay	EMB	Island	No	ADA Clearance	-	-
055	Brighton Beach	ELV	Island	No	ADA Clearance	-	-
151	145th Street St. Nicholas Ave.	SUB	Island	No	ADA Clearance		
152	135th Street	SUB	Side	Yes		$ 30.6 M	$ 39.4 M
153	125th Street St. Nicholas Ave.	SUB	Island	Yes		$ 31.4 M	$ 41.5 M
154	116th Street 8th Ave	SUB	Side	No	ADA Clearance		
155	110th St. Cathedral Pkwy	SUB	Side	No	ADA Clearance		
156	103rd Street	SUB	Side	No	ADA Clearance		
157	96th Street	SUB	Side	Yes		$ 30.8 M	$ 38.7 M
158	86th Street	SUB	Side	No	ADA Clearance		
159	81st St. Museum Of Natural History	SUB	Side	No	ADA Clearance		
160	72nd Street	SUB	Side	No	Non-compliant egress path		
161	59th Street Columbus Circle	SUB	Island	No	ADA Clearance		
167	West 4th Street	SUB	Island	No	Tier 1 Failure- train door misalignment		
211	Bedford Park Blvd.	SUB	Island	No	ADA Clearance		
212	Kingsbridge Road	SUB	Island	No	ADA Clearance		
213	Fordham Road	SUB	Island	No	ADA Clearance		
214	182nd 183rd Sts.	SUB	Side	No	ADA Clearance		
215	Tremont Avenue	SUB	Island	No	ADA Clearance		
216	174th 175th St.	SUB	Side	Yes		$ 32.2 M	$ 40.6 M
217	170th Street	SUB	Side	No	ADA Clearance	-	-
218	167th Street	SUB	Side	Yes		$ 31.9 M	$ 40.1 M
219	161st Street Yankee Stadium	SUB	Side	No	ADA Clearance		
220	155th Street 8th Ave	SUB	Side	No	ADA Clearance		
225	47-50 Streets- Rockefeller Center	SUB	Island	No	Tier 1 Failure- train door misalignment		
226	42nd Street- Bryant Park	SUB	Island	No	Tier 1 Failure- train door misalignment		
227	34th Street-Herald Square	SUB	Island	No	Tier 1 Failure- train door misalignment		
230	Broadway Lafayette	SUB	Island	No	Tier 1 Failure- train door misalignment		
231	Grand Street	SUB	Side	No	ADA Clearance		
277	7th Avenue (Manhattan)	SUB	Island	Yes		$ 32.5 M	$ 42.4 M
					TOTAL	$189.4M	$242.7M

1.0 Station Assessments

1.01 – MR 026 | Dekalb Avenue Station

Summary: *Dekalb Ave Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 29" (see figure 1).*

Description

Dekalb Ave Station is a below-grade station with two center / island platforms. The platform structures are cast-in-place concrete. The platform columns are spaced 10'-10" on center, and column faces typically measure 3'-8" from the platform edge. The platform width is 15'-8" throughout. At the platform staircases, the columns flanking the stairs measure 3'-8" from the platform edge and are touching the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 44" to 29" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

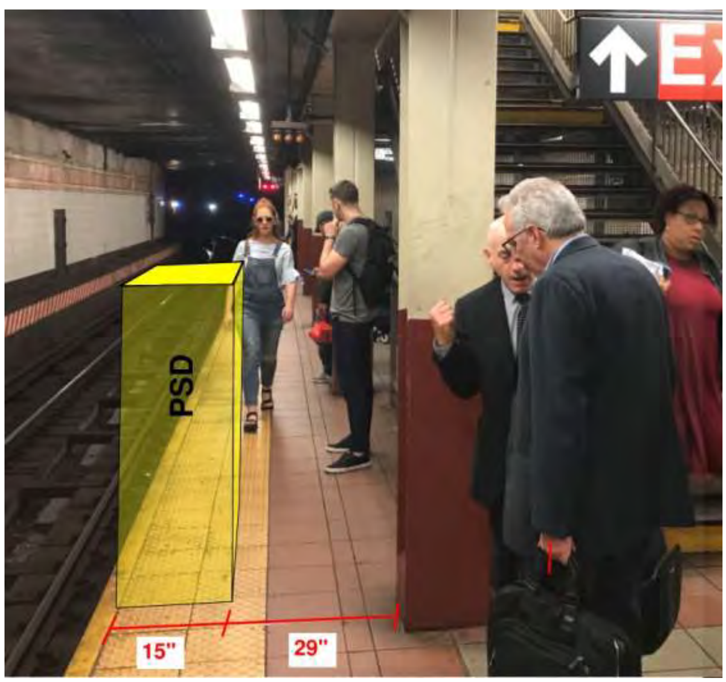

Figure 1 *– Non-Compliant ADA condition Dekalb Avenue Station*

1.02 –MR 040 | Atlantic Avenue Barclay Center Station

Summary: *Atlantic Avenue Barclay Center Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 8" (see figure 1).*

Description

The Atlantic Avenue Barclay Center Station is a below-grade station with one center / island platform. The platform structure is cast-in-place concrete. There are two rows of columns which lie 23" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum pinch point width of 32". The remaining 8" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.=

Figure 1 *– Non-compliant ADA condition*
Atlantic Avenue Barclay Center Station

1.03 – MR 041 | 7th Avenue Flatbush Station

Summary: *7th Avenue Flatbush Station is not feasible for both APGs and PSDs as the columns which are located 12" from the platform edge would prohibit the installation of a 15"-wide PSD system.*

Description:

7th Avenue Flatbush Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 12" from the platform edge, which would prevent a continuous 15"-wide barrier from being installed. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

***Figure 1 –** Column 12" from the edge*
7th Avenue Flatbush Avenue Station

1.04 – MR 042 | Prospect Park

Summary: *Prospect Park Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 31" (see figure 1).*

Description

The Prospect Park Station is an open cut station with two straight center / island platforms. The platform structures are cast-in-place concrete. The width of the platforms at the north end is 3'-10". The implementation of a platform edge barrier would reduce this width below the required minimum corridor width of 36". The remaining 31" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.=

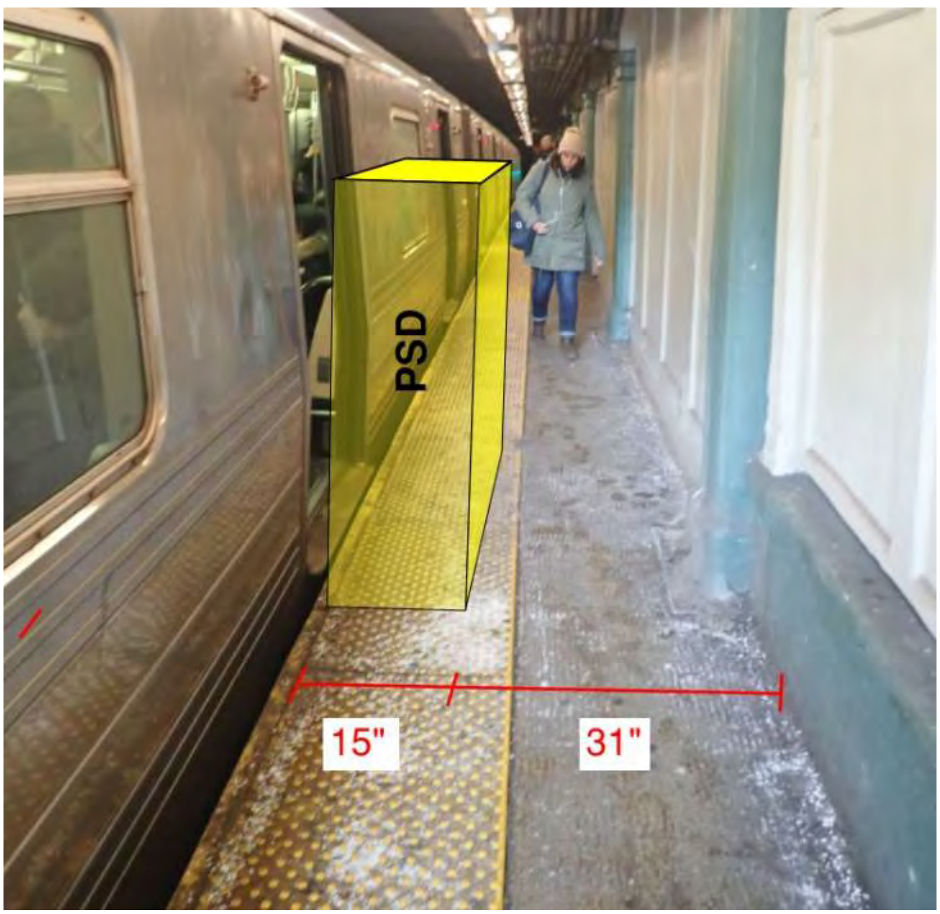

Figure 1 *– Non-compliant ADA condition*
Prospect Park Station

1.05 – MR 044 | Church Avenue Station

Summary: *Church Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 15" (see figure 1).*

Description

The Church Avenue Station is an open cut station with two straight center / island platforms. The platform structures are cast-in-place concrete. The corridor width adjacent to the station department room is 30". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 15" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Area of ADA non-compliance*
Church Avenue

1.06 – MR 047 | Newkirk Plaza Station

Summary: *Newkirk Plaza Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 13" (see figure 1).*

Description

The Newkirk Plaza Station is an open cut station with two straight center / island platforms. The platform structures are cast-in-place concrete. The pinch point width at platform columns at staircases is 28". The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 13" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

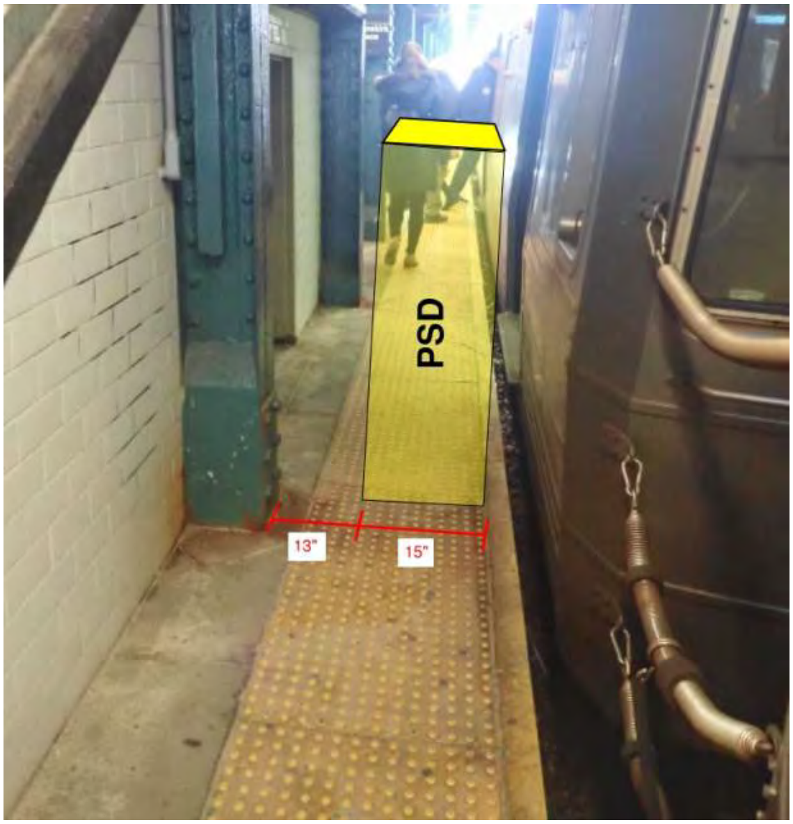

Figure 1 – *Area of ADA non-compliance*
Newkirk Plaza Station

1.07 – MR 051 | Kings Highway Station

Summary: *Kings Highway Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 23" (see figure 1).*

Description

The Kings Highway Station is an embankment station with two straight center / island platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 15'-0". At the elevator, the clearance is 3'-2". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 23" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

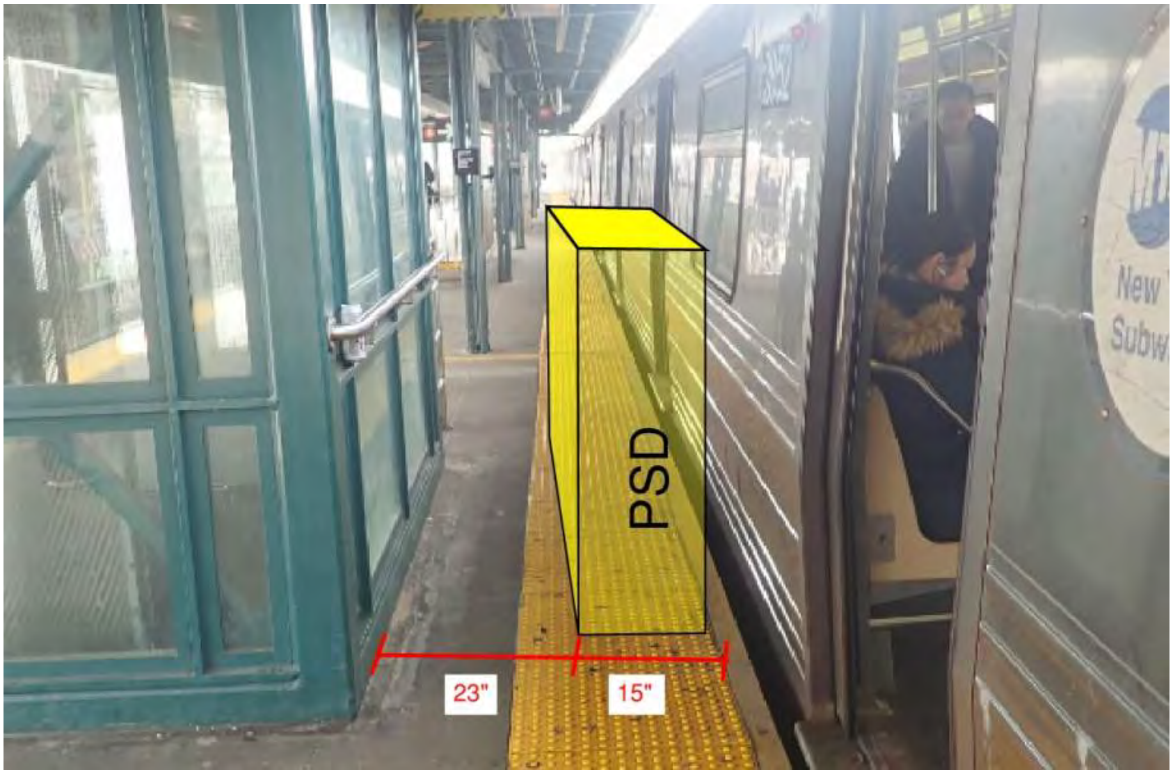

Figure 1 – *Area of ADA non-compliance*
Kings Highway Station

1.08 – MR 054 | Sheepshead Bay Station

Summary: *Sheepshead Bay Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 29" (see figure 1).*

Description

The Sheepshead Bay Station is an elevated station with two curved center / island platforms. The platform structures are cast-in-place concrete. The platform widths are approximately 15'-6". At the stairs, the clearance is 3'-8". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 29" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Area of ADA non-compliance*
Sheepshead Bay Station

1.09 – MR 055 | Brighton Beach Station

Summary: *Brighton Beach Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 29" (see figure 1).*

Description

The Brighton Beach Station is an elevated station with two curved center / island platforms. The platform structures are cast-in-place concrete. The platforms are approximately 15'-6" in width. At the four stairways, the clearance is 3'-8" from edge of platform. The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 29" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

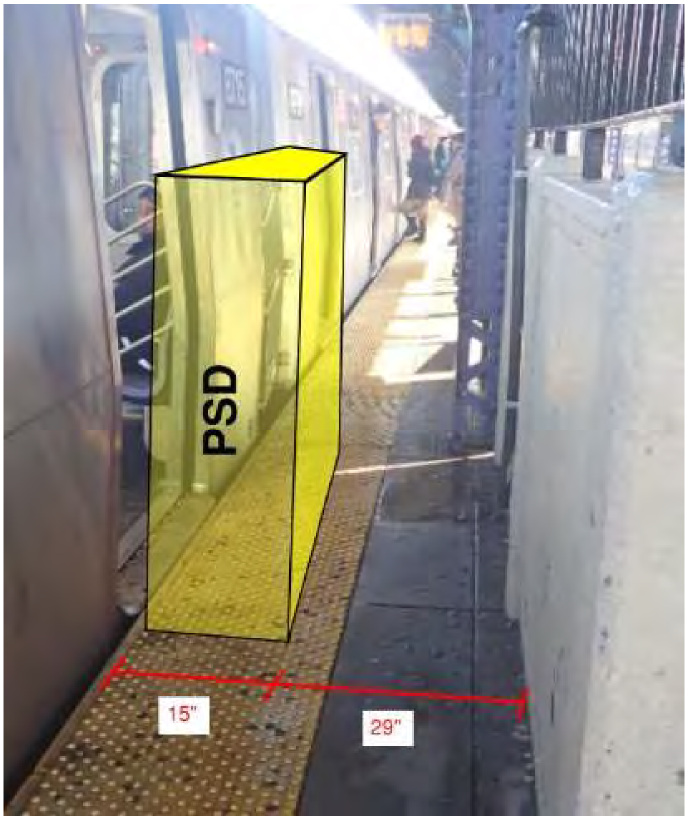

Figure 1 – *Area of ADA non-compliance*
Brighton Beach Station

1.10 – MR 151 | 145th Street St. Nicholas Avenue Station

Summary: *145th Street St. Nicholas Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 33" (see figure 1).*

Description

The 145th Street St. Nicholas Avenue Station is a below grade station with two straight center / island platforms at each level of this two-level station. The B-train service utilizes the lower level. The platform structures are cast-in-place concrete. The width of the platforms at the platform staircases is 4'-0". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 33" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA dimension*
145th Street Station

1.11– MR 152 | 135th Street Station

Summary: *135th Street Station is feasible for both APGs and PSDs. There are two ceiling mounted signals located at the center of the southbound platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The 135th Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are distributed evenly along the edges of the platform and measure 3'-4" from the platform edge. The platform width varies from approximately 7'-0" to 14'-8". On the southbound and northbound platforms there is a ceiling mounted signal located above the platform edge, with a vertical clearance of at least 7'-6". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting

Equipment Room

The equipment room can be located at the southern control area at the end of the southbound platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges appear to be original to the station construction. From our limited visual inspection and our knowledge of original station construction, structural work would at a minimum be required for the installation of an APG system.

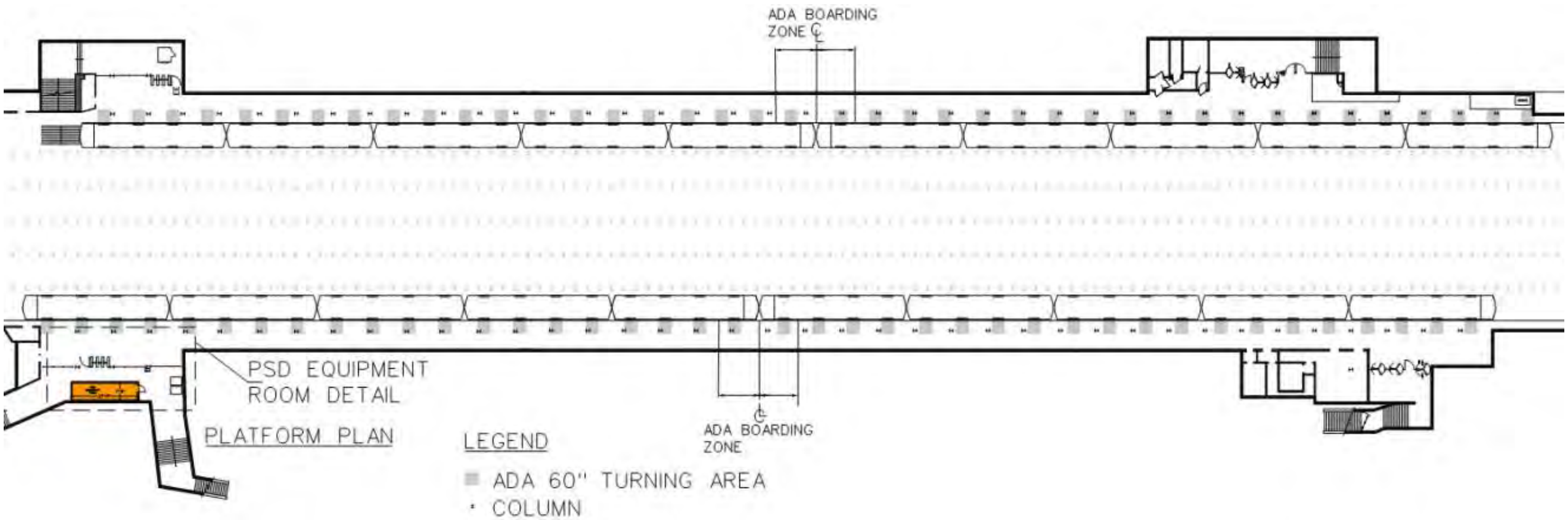

Figure 1 *– Overall Station Plan*
135th Street Station

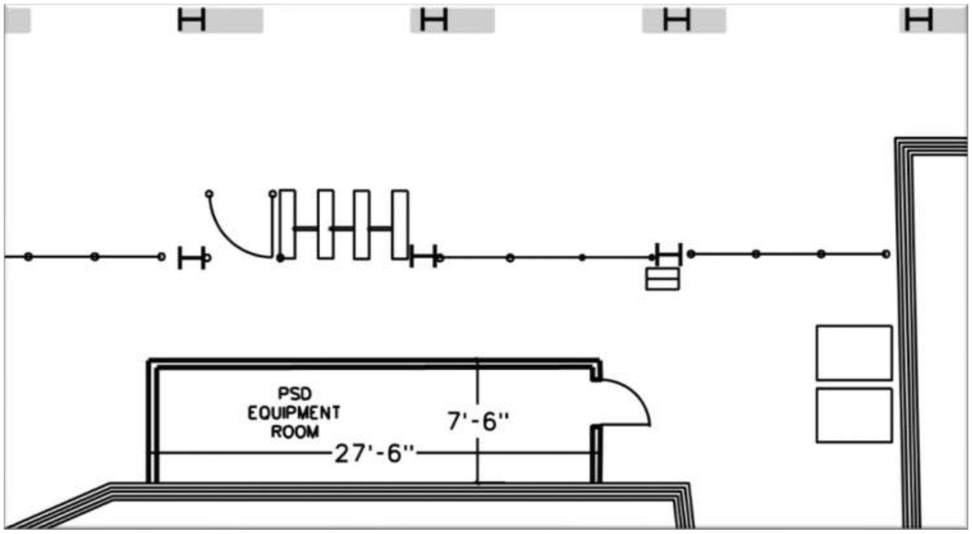

Figure 2 *– PSD Equipment Room 1 Detail*
135th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal Service)

Station Name	135th Street
Peak Demand Load from ConEd Report, (kW)	55.2 (combined)
Apparent Power (kVA)	69.0
Station Peak Demand Load, Max Current, (A)	192.0
Maximum Amount of Doors	80
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	387
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	413
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis (Normal Service)

Station
Power Capacity Analysis (Reserve Service)

Station Name	135th Street
Peak Demand Load from ConEd Report, (kW)	55.2 (combined)
Apparent Power (kVA)	69.0
Station Peak Demand Load, Max Current, (A)	192.0
Maximum Amount of Doors	80
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	387
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	413
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 2. Power Capacity Analysis (Reserve Service)

Historic Restrictions:
None.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions is listed in the attached ROM estimate. The total cost for this station is estimated to be $30.6M to install APGs and $39.4M to install PSDs (See Appendix E).

Figure 3 – Typical platform view with signal light
135th Street Station

1.12 – MR 153 | 125th Street St. Nicholas Ave. Station

Summary: *125th Street St. Nicholas Ave. Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

125th Street St. Nicholas Ave. Station is a below-grade station with two center / island platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are distributed evenly along the center of each platform and measure 8'-4" from the platform edge. The platform widths vary from approximately 17'-4" to 17'-10". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting

Equipment Room

The equipment room can be located at the center of the station mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

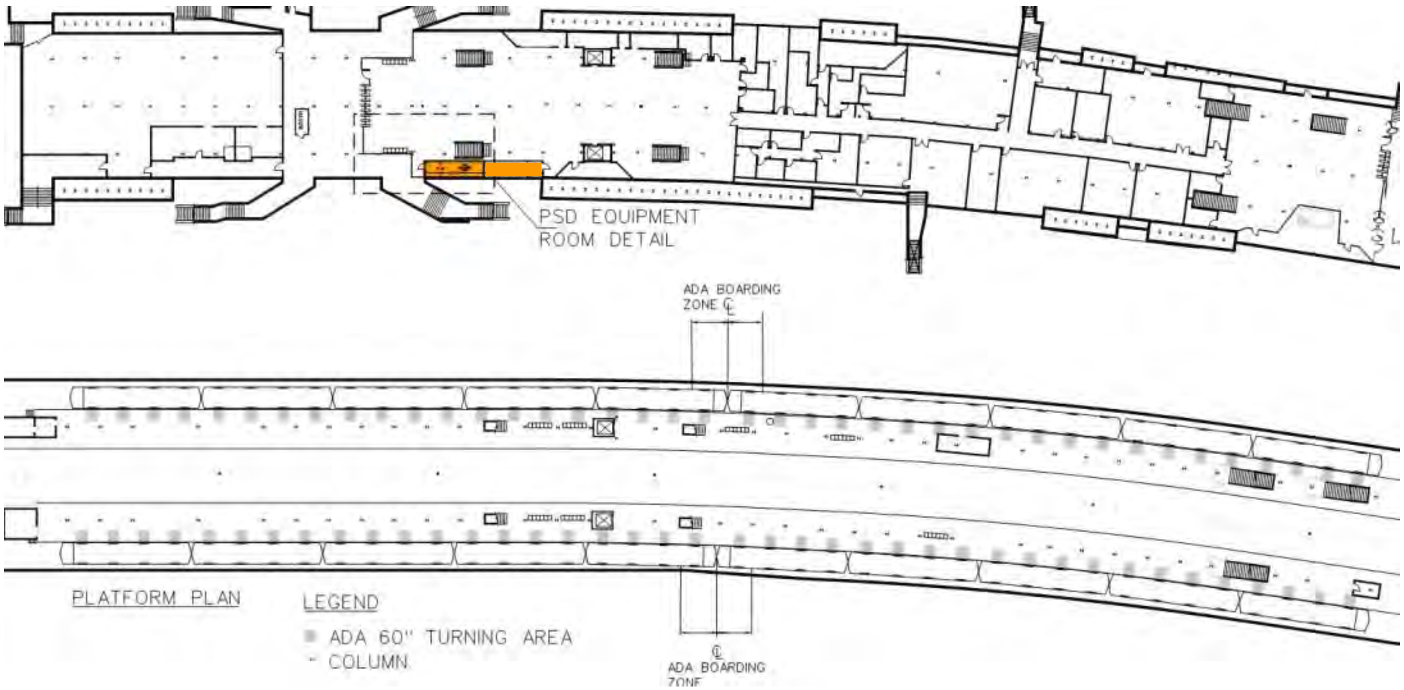

Figure 1 *– Overall Station Plan*
125th Street Station

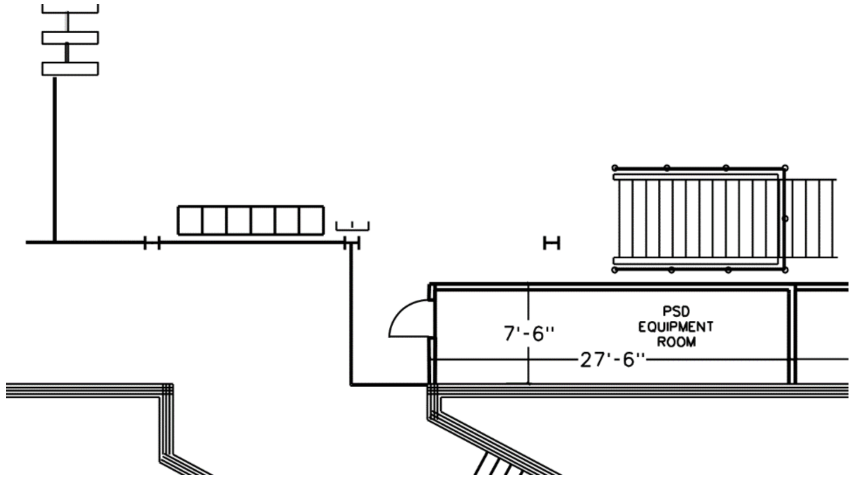

***Figure 2** – PSD Equipment Room Detail*
125th Street Station

***Figure 3** – Typical platform view*
125th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal Service)

Station Name	125th Street St. Nicholas Ave.
Peak Demand Load from ConEd Report, (kW)	245.6 (combined)
Apparent Power (kVA)	307.0
Station Peak Demand Load, Max Current, (A)	852.8
Maximum Amount of Doors	160
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	1193
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	7
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 1200A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis (Normal Service)

Station
Power Capacity Analysis (Reserve Service)

Station Name	125th Street St. Nicholas Ave.
Peak Demand Load from ConEd Report, (kW)	245.6 (combined)
Apparent Power (kVA)	307.0
Station Peak Demand Load, Max Current, (A)	852.8
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	1193
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	7
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 1200A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve

Table 2. Power Capacity Analysis (Reserve Service)

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.4M to install APGs and $41.5M to install PSDs (See Appendix E)

1.13 – MR 154 | 116th Street / 8th Ave Station

Summary: *116th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 19" (see figure 1).*

Description

116th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 11'-8" throughout. The width at the south end of the northbound platform is 34". The implementation of a platform edge barrier would reduce this already noncompliant width below the required minimum corridor requirement of 36". The remaining 19" or less* would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – Non-Compliant ADA condition
116th Street Station

1.14– MR 155 | 110th St. Cathedral Pkwy Station

Summary: *110th St. Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 21" (see figure 1).*

Description

110th St. Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-0' to 11'-8". The implementation of a platform edge barrier would reduce this lesser (already noncompliant) width below the required minimum corridor requirement of 36". The remaining 21" or less* would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

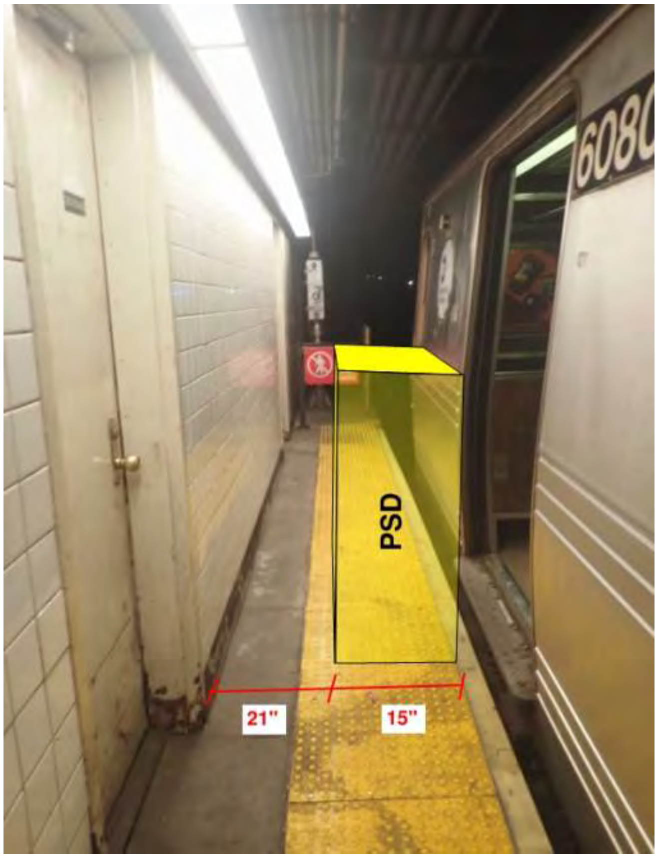

Figure 1 – Non-Compliant ADA condition
110th Street

1.15– MR 156 | 103rd Street Station

Summary: *103rd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 13" (see figure 1).*

Description

103rd Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 2'-4' to 10'-0". The implementation of a platform edge barrier would reduce this lesser (already noncompliant) width, below the required minimum corridor requirement of 36". The remaining 13" or less* would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – Non-Compliant ADA condition
103rd Street

1.16 – MR 157 | 96th Street Station

Summary: *96th Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The 96th Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are distributed evenly along the center of each platform and measure 3'-4" from the platform edge. The platform widths vary from approximately 11'-8" to 12'-0". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting

Equipment Room

The equipment room can be located at the northern control area at the end of the northbound platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges appear to be original to the station construction. From our limited visual inspection and our knowledge of original station construction, structural work would at a minimum be required for the installation of an APG system.

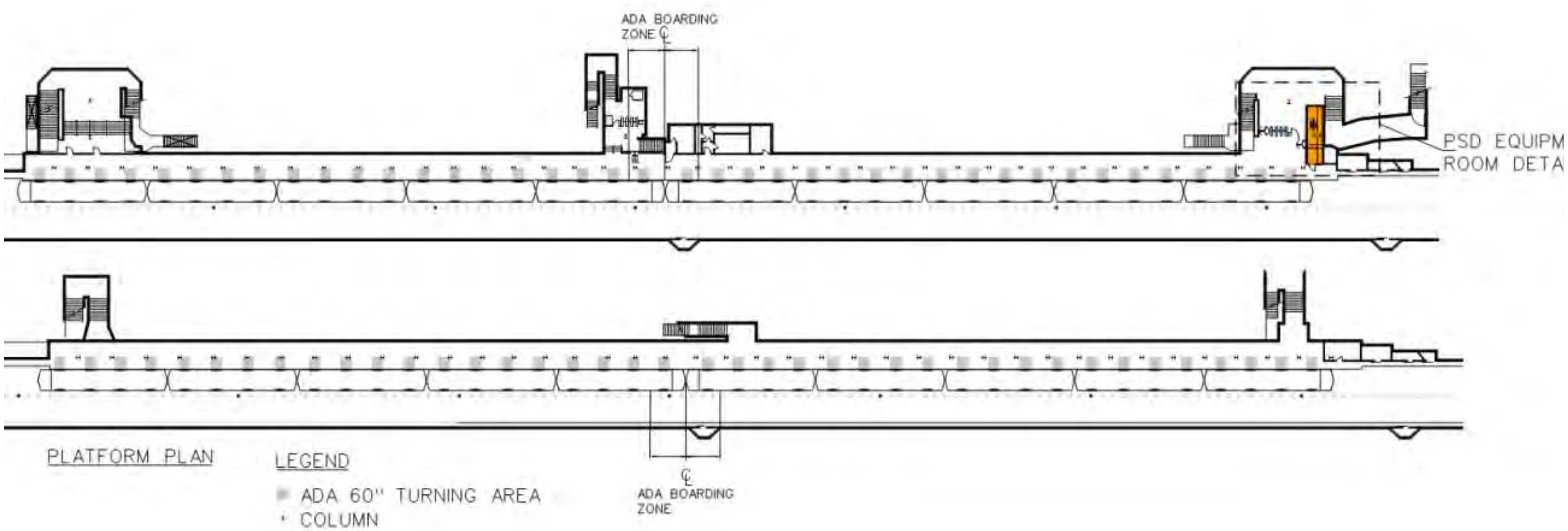

Figure 1 *– Overall plan*
96th Street Station

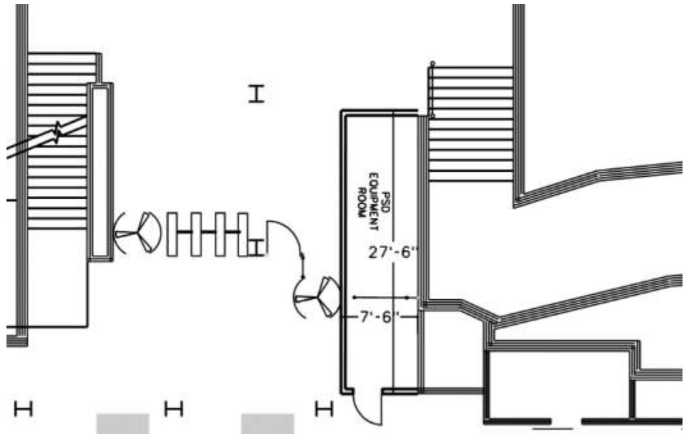

***Figure 2** – PSD Equipment Room Detail*
96th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of a APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal Service)

Station Name	96th Street
Peak Demand Load from ConEd Report, (kW)	47.2 (combined)
Apparent Power (kVA)	59.0
Station Peak Demand Load, Max Current, (A)	163.9
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	358
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	442
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the field survey(photos) having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve. 1 line diagram provided does not have service rating and is incomplete.

Table 1. Power Capacity Analysis (Normal Service)

Station
Power Capacity Analysis (Reserve Service)

Station Name	96th Street
Peak Demand Load from ConEd Report, (kW)	47.2 (combined)
Apparent Power (kVA)	59.0
Station Peak Demand Load, Max Current, (A)	163.9
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	358
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	442
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the field survey(photos) having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve. 1 line diagram provided does not have service rating and is incomplete.

Table 2. Power Capacity Analysis (Reserve Service)

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $30.8M to install APGs and $38.7M to install PSDs (See Appendix E)

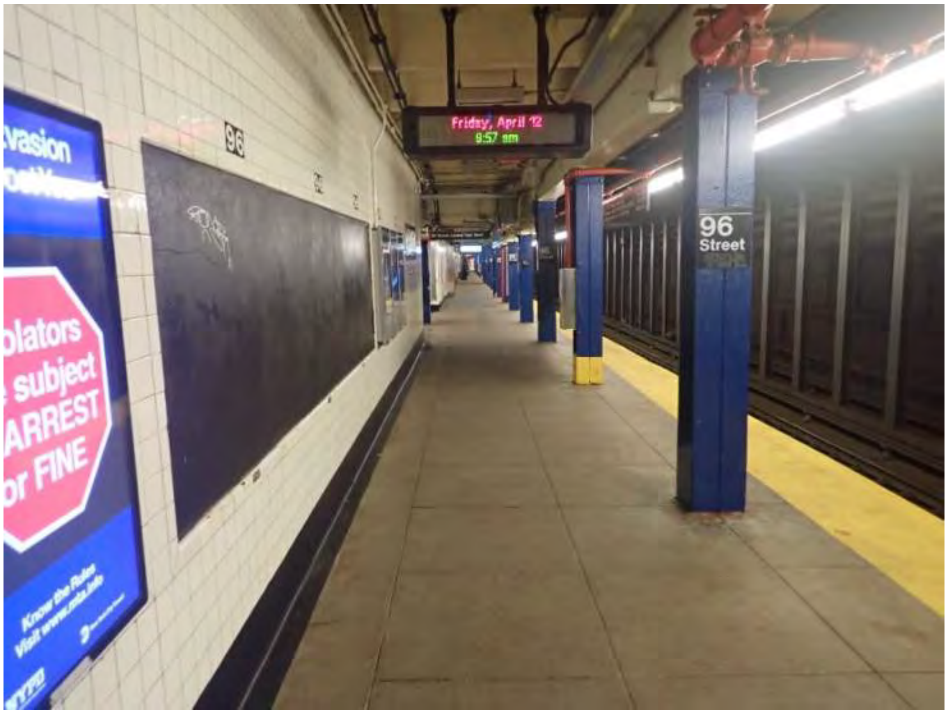

***Figure 3** – General platform view*
96th Street Station

1.17 – MR 158 | 86th Street Station

Summary: *86th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 21" (see figure 1).*

Description

86th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-0' to 11'-8". The implementation of a platform edge barrier would reduce this lesser width below the required minimum corridor requirement of 36". The remaining 21" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
86th St Station

1.18 – MR 159 | 81st St. Museum of Natural History

***Summary:** 81st St. Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

81st St. Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 3'-4' to 11'-10". The implementation of a platform edge barrier would reduce this lesser width below the required minimum corridor requirement of 36". The remaining 25" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – Non-Compliant ADA condition
81st St. Station

1.19 – MR 160 | 72nd Street Station

Summary *72nd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the north end of the southbound platform as the existing width is 4'-8" (see figure 1).*

Description

72nd Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 4'-8' to 11'-10". The north end of the southbound platform in the photo below, is 4'-8" in width. Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

Figure 1 – Non-Compliant ADA condition
72nd Street Station

1.20 – MR 161 | 59th Street Columbus Circle Station

Summary: *59th Street Columbus Circle Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 21" (see figure 1).*

Description

59th Street Columbus Circle Station is a below-grade station consisting of two center / island platforms (there is a third island platform which is closed to the public). The platform widths vary from approximately 10'-8" – 29'-0". The platforms are mildly curved with two rows of columns approximately 3'-4" from edge of platform. At the platform staircases, the columns measure 3'-0" from the platform edge and 2'-2" from the staircase (see figure 1 for reference).The implementation of a platform edge barrier would reduce the currently compliant width of 36" to 21" or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

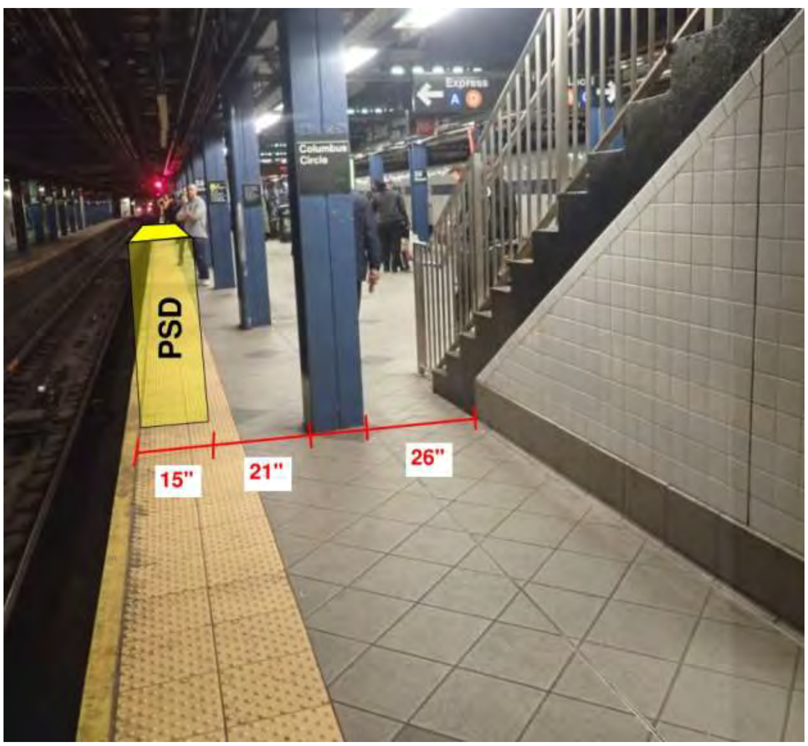

Figure 1 *–platform*
59th Street Columbus Circle Station

1.21 – MR 211 | Bedford Park Blvd Station

Summary: *Bedford Park Blvd Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

Bedford Park Blvd. Station is a below-grade station consisting of two center / island platforms. The platform widths are approximately 19'-0" throughout. The platforms are straight with two rows of columns approximately 3'-4" from edge of platform. At the platform staircases, the columns measure 3'-4" from the platform edge and 26" from the staircase (see figure 1 for reference).The implementation of a platform edge barrier would reduce the currently compliant width of 40" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *–platform*
Bedford Park Blvd Station

1.22 – MR 212 | Kingsbridge Road Station

Summary: *Kingsbridge Road Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

Kingsbridge Road Station is a below-grade station consisting of two center / island platforms. The platform widths are approximately 19'-6" throughout. The platforms are straight with two rows of columns approximately 3'-4" from edge of platform. At the platform staircases, the columns measure 3'-4" from the platform edge and 1'-8" from the staircase (see figure 1 for reference). The implementation of a platform edge barrier would reduce the currently compliant width of 40" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *–platform*
Kingsbridge Road Station

1.23 – MR 213 | Fordham Road Station

Summary: *Fordham Road Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

Fordham Road Station is a below-grade station consisting of one center / island platform. The platform width varies from approximately 10'-8" to 54'-8" throughout. The platforms are straight with two rows of columns approximately 3'-4" from edge of platform. At the platform staircases, the columns measure 3'-4" from the platform edge and 1'-10" from the staircase (see figure 1 for reference). The implementation of a platform edge barrier would reduce the currently compliant width of 40" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *–platform*
Fordham Road Station

1.24 – MR 214 | 182nd-183rd St Station.

***Summary:** 182nd-183rd St Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1).*

Description

182nd-183rd St Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The platform widths are approximately 11'-8" throughout. The platforms are straight with one row of columns approximately 3'-4" from edge of platform. At the platform staircases, the columns measure 3'-4" from the platform edge and 2'-0" from the staircase (see figure 1 for reference). The implementation of a platform edge barrier would reduce the currently compliant width of 40" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

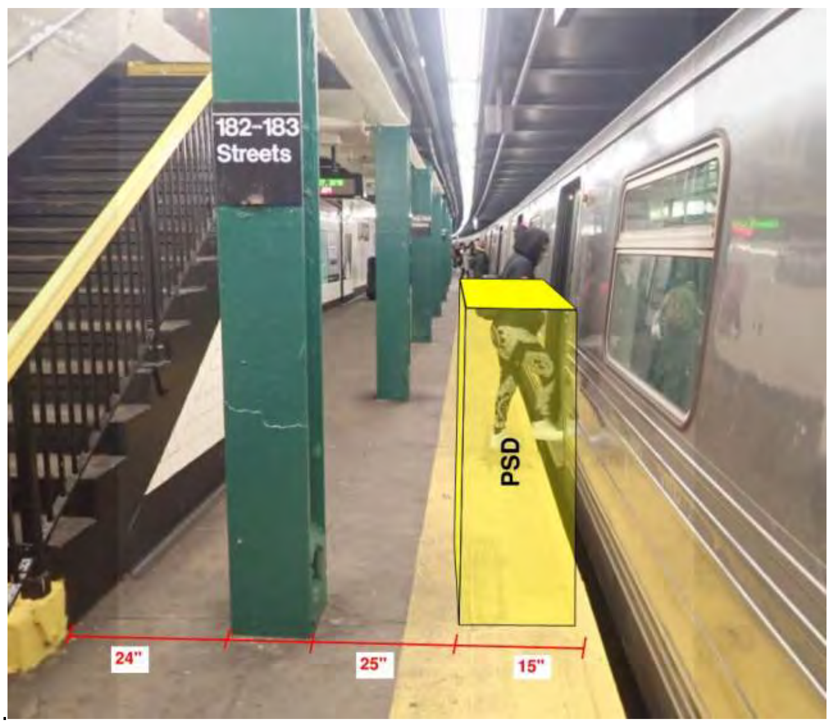

***Figure 1** – Non-Compliant ADA condition*
182nd-183rd Sts Station

1.25 – MR 215 | Tremont Avenue Station

Summary: *Tremont Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1).*

Description

Tremont Avenue Station is a below-grade station consisting of two center / island platforms. The platform widths are approximately 22'-0" throughout. The platforms are straight with two rows of columns approximately 3'-4" from edge of platform. At the platform staircases, the columns measure 3'-4" from the platform edge and 1'-4" from the staircase (see figure 1 for reference). The implementation of a platform edge barrier would reduce the currently compliant width of 40" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
Tremont Avenue

1.26 – MR 216 | 174th-175th St Station

Summary: *174th-175th St Station is feasible for both APGs and PSDs. There are two ceiling mounted monitors located at the center of the southbound platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The 174th-175th St Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are columns evenly distributed along the platform edge measuring 3'-6" from the platform edge. The platform widths vary from approximately 10'-8" to 21'-0". On the southbound platform there are two ceiling mounted signals located above the platform edge, with a vertical clearance of at least 6'-8". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting

Equipment Room

The equipment room can be located at the edge of the station mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

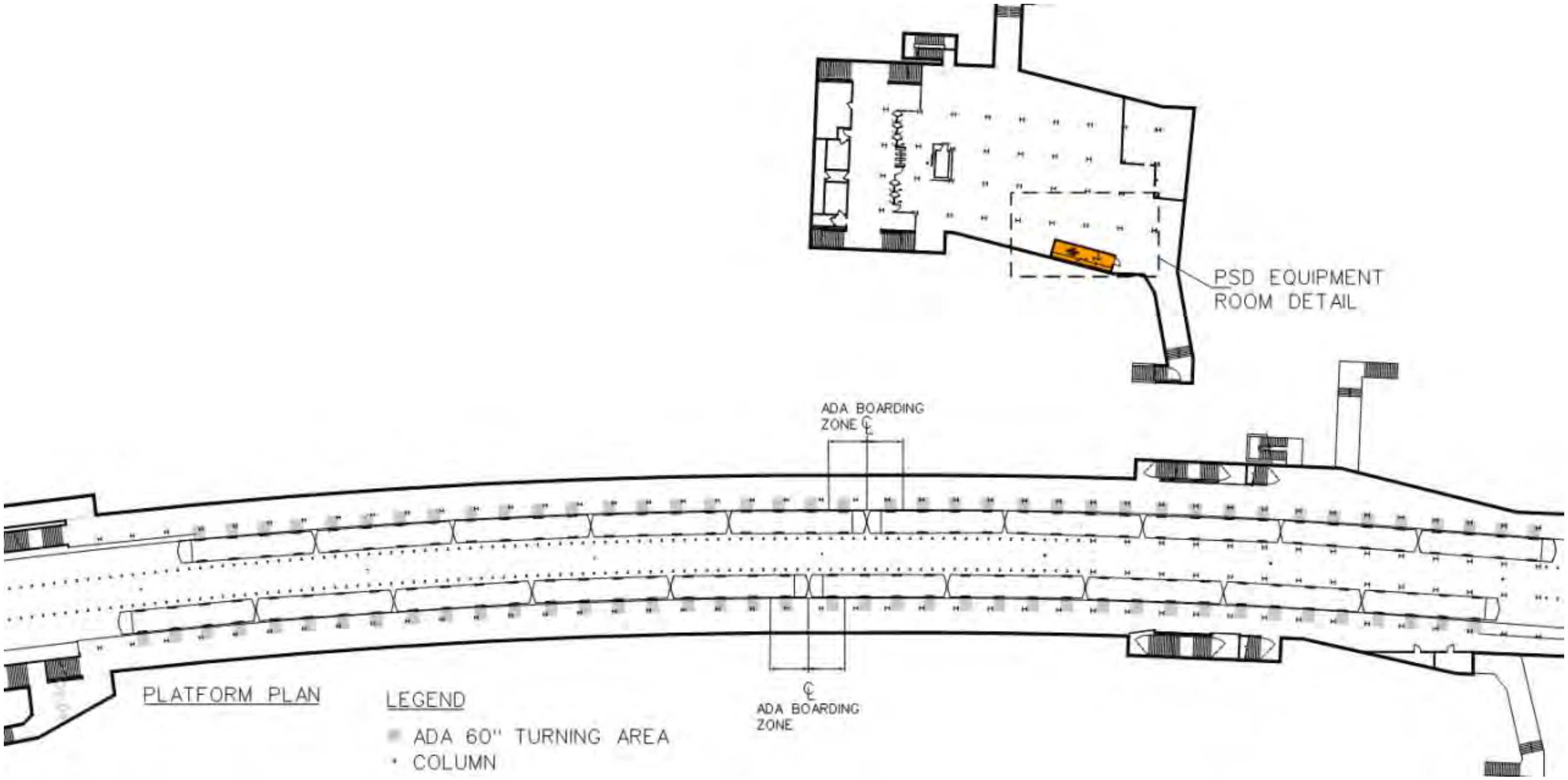

Figure 1 *– Overall plan*
174th - 175th Street Station

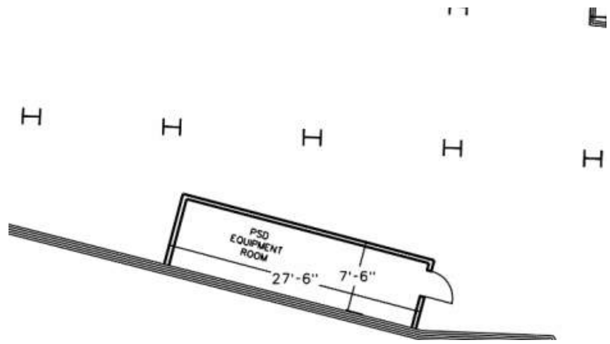

***Figure 2** – PSD Equipment Room Detail*
174th - 175th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of a APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal Service)

Station Name	174th 175th St.
Peak Demand Load from ConEd Report, (kW)	70.8 (combined)
Apparent Power (kVA)	88.5
Station Peak Demand Load, Max Current, (A)	245.8
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	440
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	360
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis (Normal Service)

Station
Power Capacity Analysis (Reserve Service)

Station Name	174th 175th St.
Peak Demand Load from ConEd Report, (kW)	70.8 (combined)
Apparent Power (kVA)	88.5
Station Peak Demand Load, Max Current, (A)	245.8
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	440
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	360
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve

Table 2. Power Capacity Analysis (Reserve Service)

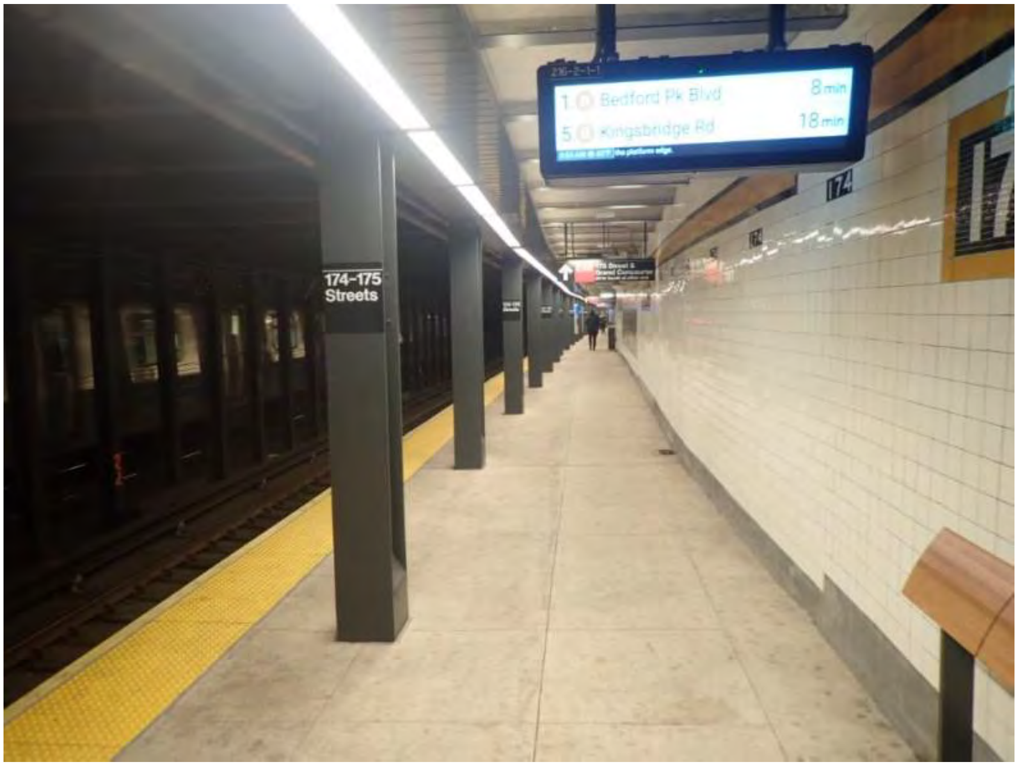

***Figure 3** – General platform view*
174th -175th St Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.2M to install APGs and $40.6M to install PSDs (See Appendix E)

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1.27 – MR 217 | 170th Street Station

Summary: *170th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1).*

Description

170th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The platform widths are approximately 11'-4" throughout. The platforms are straight with one rows of columns approximately 3'-4" from edge of platform. At the platform staircases, the columns measure 3'-4" from the platform edge and 1'-8" from the staircase (see figure 1 for reference). The implementation of a platform edge barrier would reduce the currently compliant width of 40" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – Non-Compliant ADA condition
170th Street

1.28 – MR 218 | 167th Street Station

Summary: *167th Street Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The 167th Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. The platform widths vary from approximately 11'-4" to 13'-8". There are columns evenly distributed along the platform edge measuring 3'-4" from the platform edge. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting

Equipment Room

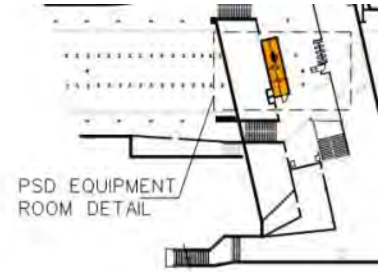
The equipment room can be located at the center of the station mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.



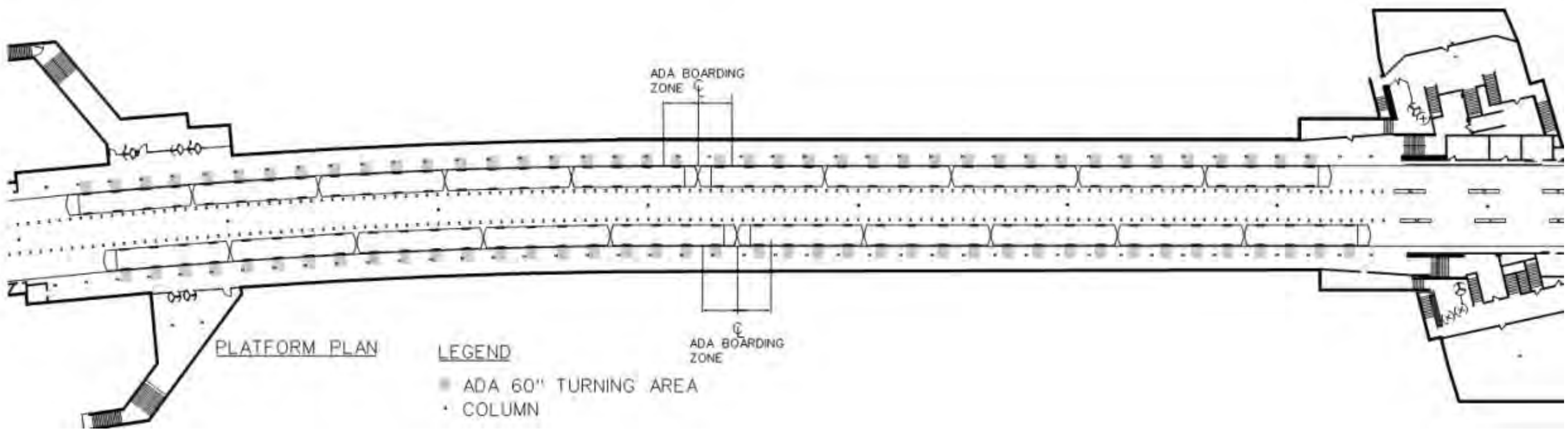


Figure 1 *– Overall plan*
167th Street Station

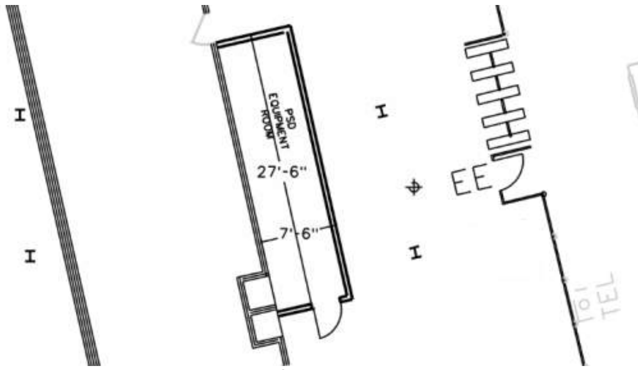


Figure 2 *– PSD Equipment Room Detail*
167th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of a APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal Service)

Station Name	167th Street
Peak Demand Load from ConEd Report, (kW)	87.8 (combined)
Apparent Power (kVA)	109.8
Station Peak Demand Load, Max Current, (A)	304.9
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	499.5
Station Service Power Capacity,(A)	800
Service Spare Capacity, (A)	301
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis (Normal Service)

Station
Power Capacity Analysis (Reserve Service)

Station Name	167th Street
Peak Demand Load from ConEd Report, (kW)	87.8 (combined)
Apparent Power (kVA)	109.8
Station Peak Demand Load, Max Current, (A)	304.9
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	499.5
Station Service Power Capacity,(A)	800
Service Spare Capacity, (A)	301
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve

Table 2. Power Capacity Analysis (Reserve Service)

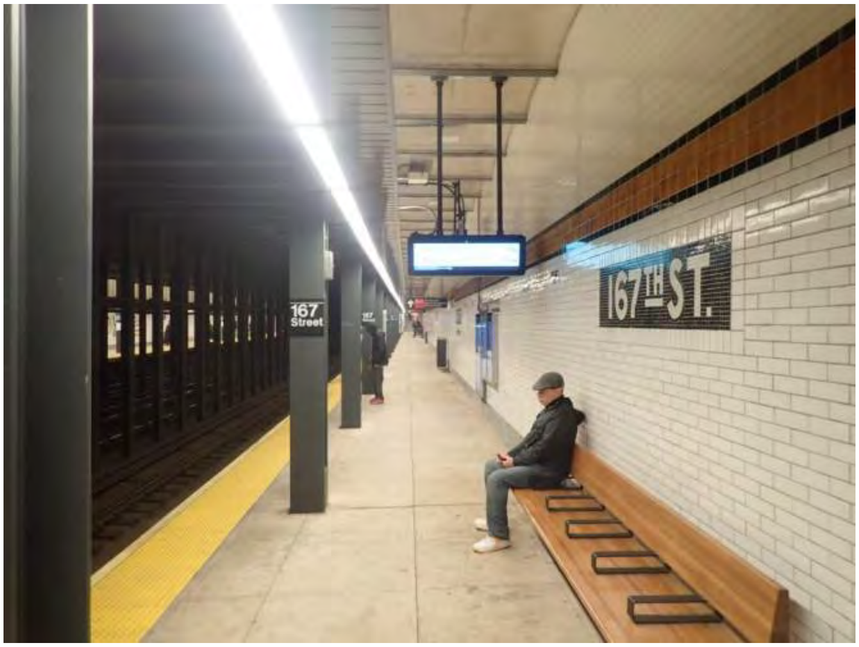


Figure 3 *– General platform view*
167th Street Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.9M to install APGs and $40.1M to install PSDs (See Appendix E)

1.29 – MR 219 | 161st Street Yankee Stadium Station

***Summary:** 161st Street Yankee Stadium Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met on the northbound platform as the remaining width would be 27" (see figure 1).*

Description

161st Street Yankee Stadium Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The platform widths are approximately 15'-4" throughout. The platforms are straight with one rows of columns approximately 3'-6" from edge of platform. At the northern end of the northbound platform, the columns measure 3'-6" from the platform edge and 1'-8" from a vent wall (see figure 1 for reference). The implementation of a platform edge barrier would reduce the currently compliant width of 38" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – Non-Compliant ADA condition
161st Street Yankee Stadium Street

1.30 – MR 220 | 155th Street 8th Avenue Station

__Summary:__ 155th Street 8th Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 23" (see figure 1).

Description

The 155th Street 8th Avenue Station is a below grade station with two straight side platforms. The platform structures are cast-in-place concrete. The platform widths are approximately 15'-4" throughout. The platforms are straight with one rows of columns approximately 3'-2" from edge of platform. At the platform staircases, the columns measure 3'-2" from the platform edge and 1'-4" from the staircase (see figure 1 for reference). The implementation of a platform edge barrier would reduce the currently compliant width of 38" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

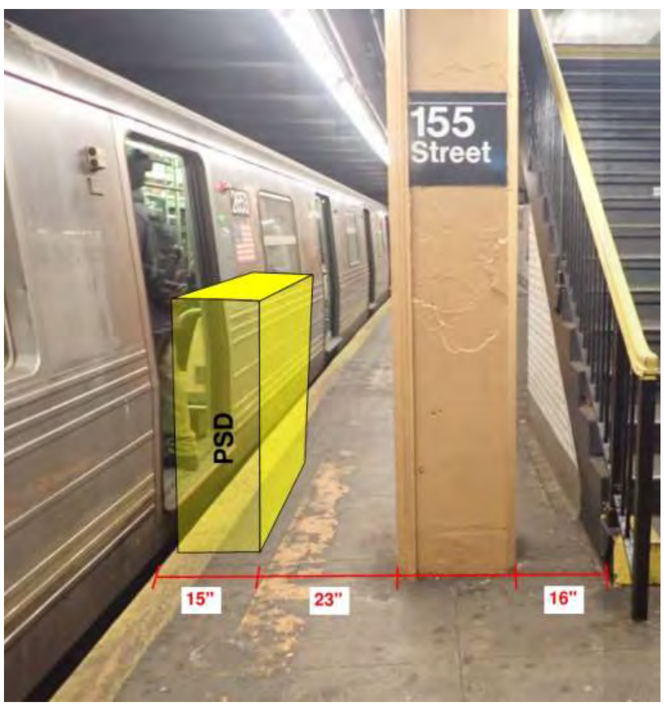


***Figure 1** – Area of ADA non-compliance*
155th Street 8th Ave Station

1.31 – MR 231 | Grand Street Station

Summary: *Grand Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 27" (see figure 1).*

Description

The Grand Street Station is a below grade station with two straight side platforms. The platform structures are cast-in-place concrete. The platform widths are approximately 8'-8" throughout. The platforms are straight with one rows of columns approximately 3'-6" from edge of platform. At the platform staircases, the columns measure 3'-6" from the platform edge and 1'-8" from the staircase (see figure 1 for reference). The implementation of a platform edge barrier would reduce the currently compliant width of 42" to 27" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

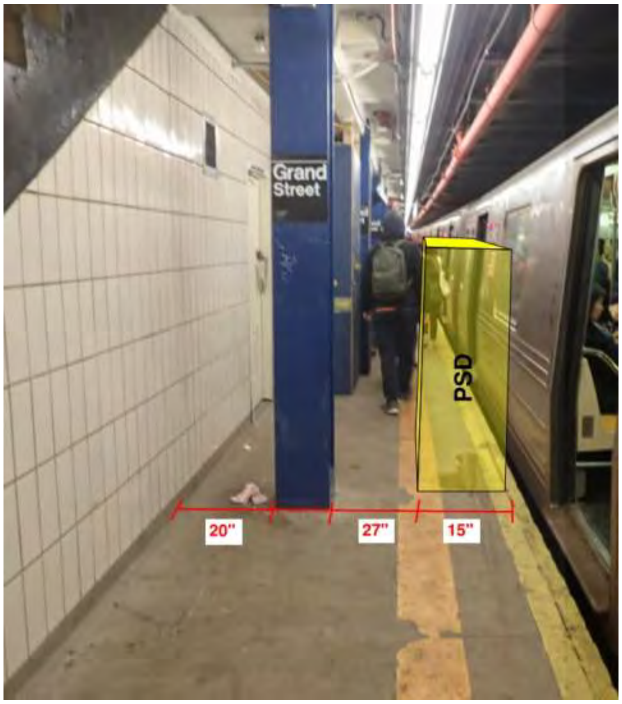


Figure 1 – *Area of ADA non-compliance*
Grand Street Station

1.32 – MR 277 | 7th Avenue Station

Summary: *7th Avenue Station is feasible for both APGs and PSDs. There are four ceiling mounted signals located at the lower platform edges which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG system (see structural report; Appendix B). Existing power is adequate.*

Description

7th Avenue Station is a below-grade station with two levels of center / island platforms **(see Figure 1)**. The B train utilizes the south side of both the upper and lower platform. The platform structures are cast-in-place concrete. At the upper level platform, column faces are typically 5'-4" from the platform edge and the platform measures 29'-4" wide throughout. At the lower level platform column faces typically measure 2'-8" from the Queens-bound platform edge and 3'10" from the Uptown-bound platform edge. The platform width varies from 13'-0" to 24'-8". On the lower platform there are four ceiling mounted signals located above the platform edge, measuring no less than 7'-4" above the ground. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Ceiling mounted signals located above the platform edge would need to be relocated in the implementation of full height PSDs.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

Since there are 4 platform edges at this station, 2 full size equipment rooms would be required. The equipment rooms could be located at the western end of the upper level platform adjacent to staircase P9 and at the center of the lower platform (**see Figure 1, Figure 2 & Figure 3).** The proposed room dimension are 27'-0" x 6'-6" each.

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed in the 1990s. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would at a minimum be required for the installation of an APG system.

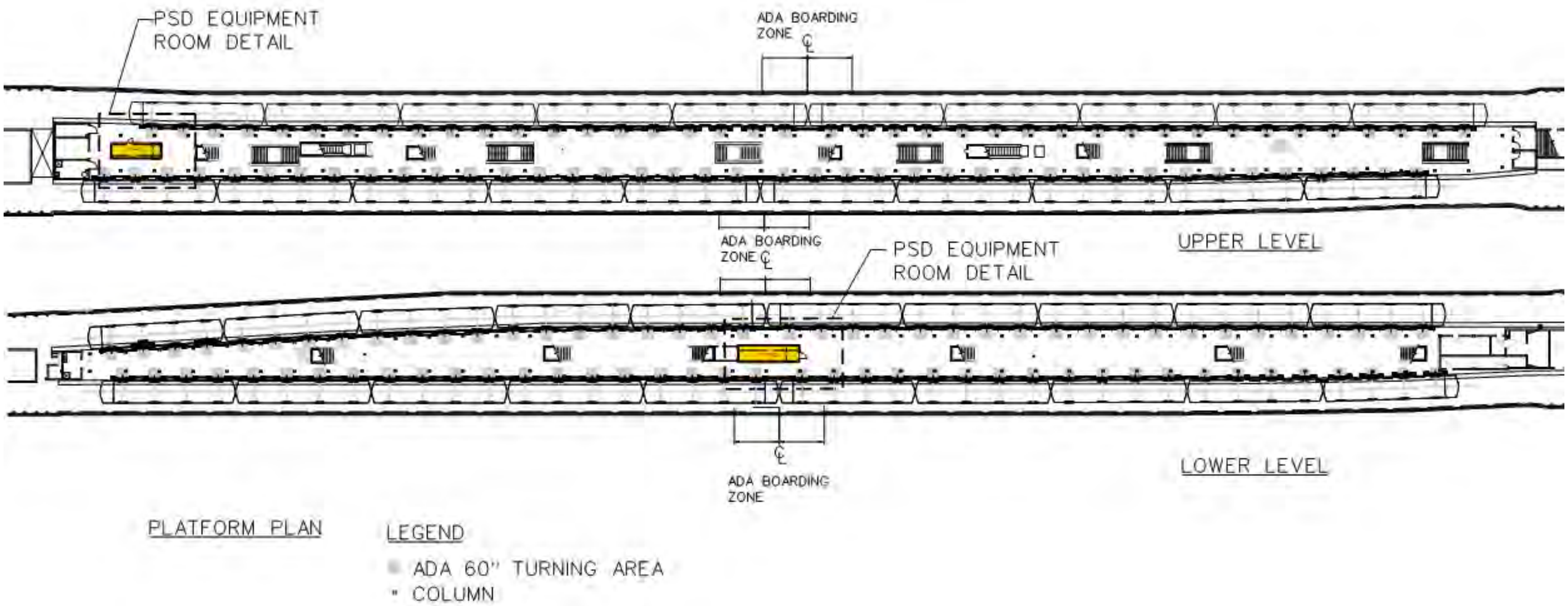


***Figure 1** – Overall Station Plan*
7th Avenue Station

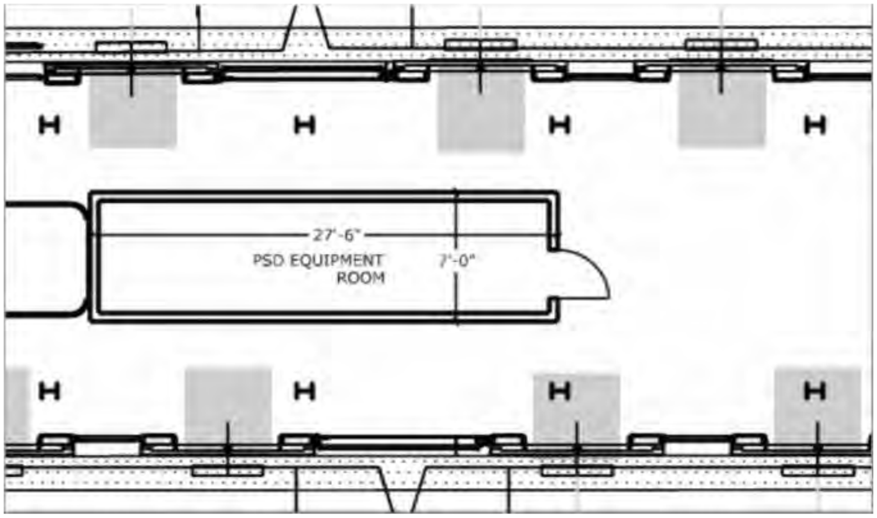


Figure 2 *– PSD Equipment Room 1 Detail*
7th Avenue Station

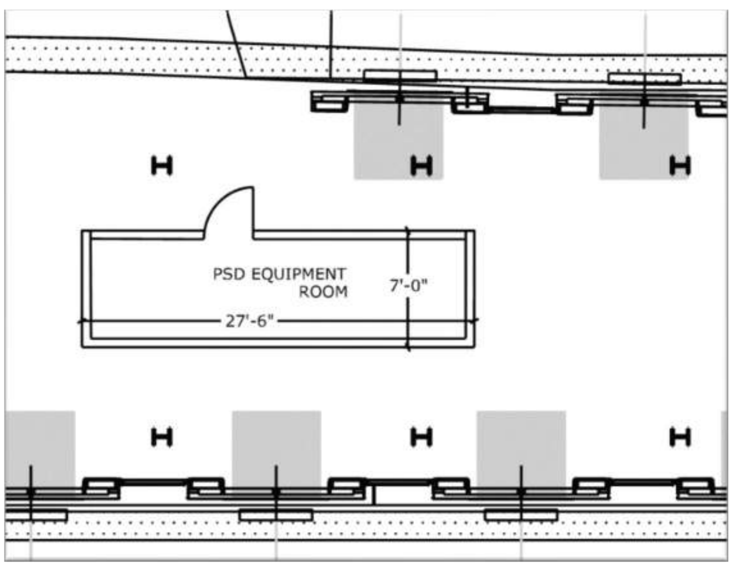


Figure 3 *– PSD Equipment Room 2 Detail*
7th Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	7th Avenue
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	76.8
Apparent Power (kVA)	96.0
Station Peak Demand Load, Max Current, (A)	266.7
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.8
Total Load (Station Peak + PSD), (A)	607
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	193
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram. Station has (2) separate meter reading, for each Normal & Reserve service.

Table 1- *Power Capacity Analysis (Normal)*

Station Power Capacity Analysis (Reserve service)

Station Name	7th Avenue
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	78.0
Apparent Power (kVA)	97.5
Station Peak Demand Load, Max Current, (A)	270.8
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.8
Total Load (Station Peak + PSD), (A)	612
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	188
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram. Station has (2) separate meter reading, for each Normal & Reserve service.

Table 2- *Power Capacity Analysis (Reserve)*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.5M to install APGs and $42.4M to install PSDs (See Appendix E)

***Figure 4** – Typical platform view*
7th Avenue Station

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for <u>Tier 2 Stations'</u> screening will include the following:*
>
> *a. Column location in relation to the platform edge*
> *b. Platform edge clearance adjacent to stairs and other impediments*
> *c. Impacts to ADA path of travel and boarding areas*
> *d. Conflicts of PSD/APG/RPSDs with Signals cables*
> *e. Sufficient platform width*
> *f. Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for <u>Tier 3 Stations</u> will include the following:*
>
> *a. Structural capacity of platforms to accept PSD/APG/RPSDs*
> *b. Feasibility & location for PSD/APG/RPSDs equipment room*
> *c. Confirmation of adequate power for PSD/APG/RPSDs*
> *d. Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> *e. Determination of communications requirements, availability and cost*
> *f. Determination of gap detection and entrapment avoidance technology requirements*
> *g. Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
   - Double the amount of motors as PSDs (each motor operating a single leaf).
   - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
   - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
   - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY. Status of doors will be provided to crew via indicator lights, with no automated propulsion cutout.

If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

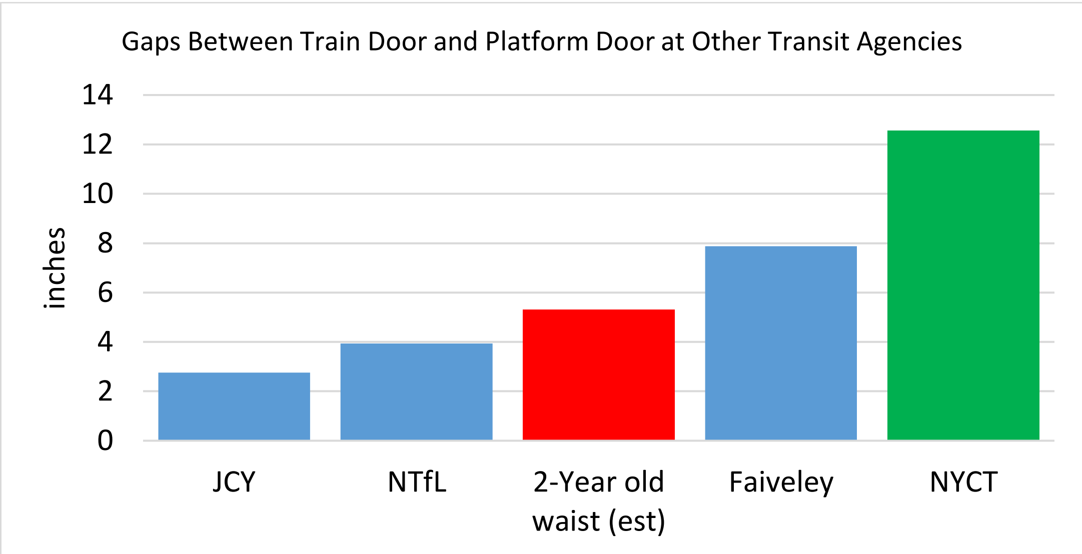


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

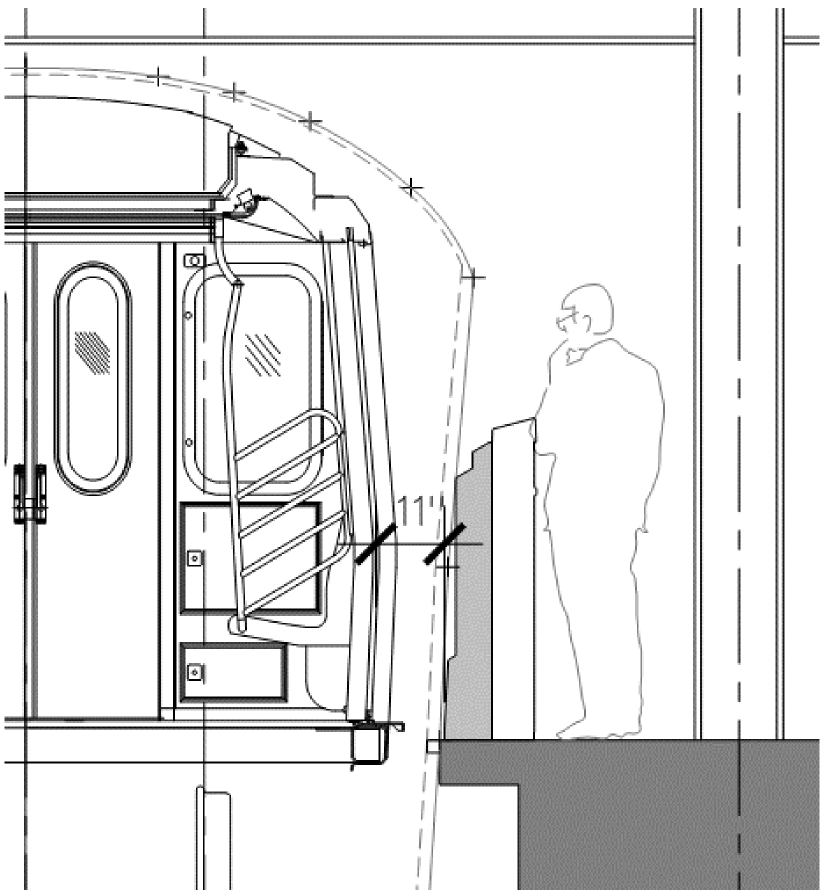


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber “bumpers” on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6” into the line equipment envelope. This would leave a 5” gap between the platform and car doors allowing approximately 2” of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5" by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor's window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor's window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **<u>bold/underline</u>**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	PSD System 1	PSD System 2	PSD System 3
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are "existing" as defined by code. All the rolling stock is also to be considered "existing" under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60" radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36" of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

304 Turning Space

304.1 General. Turning space shall comply with 304.

304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.

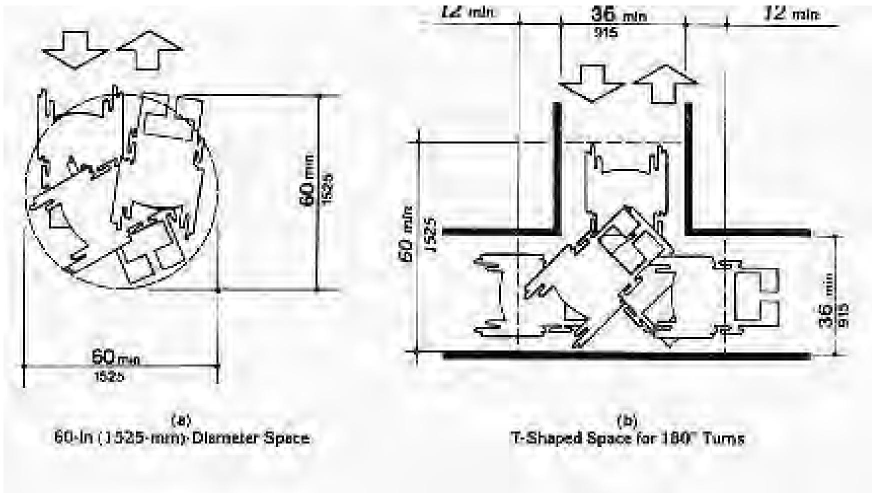
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

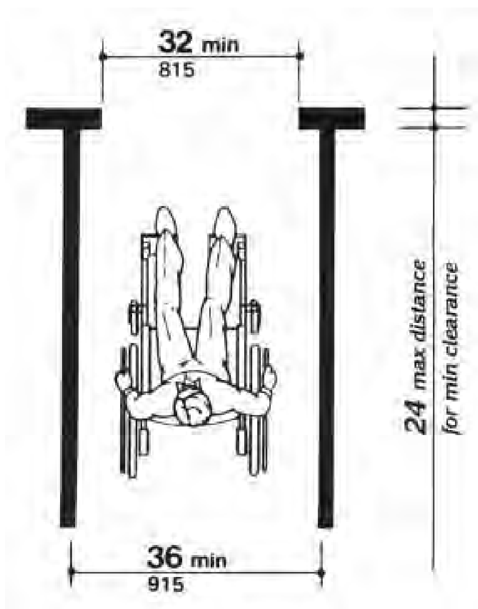


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

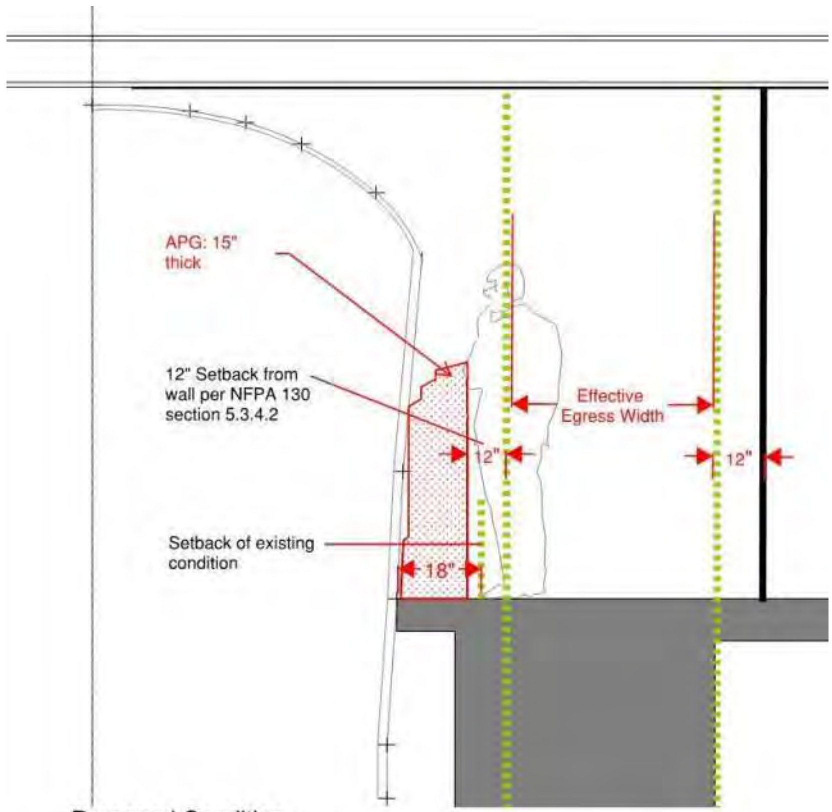
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15" of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

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Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

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Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

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DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

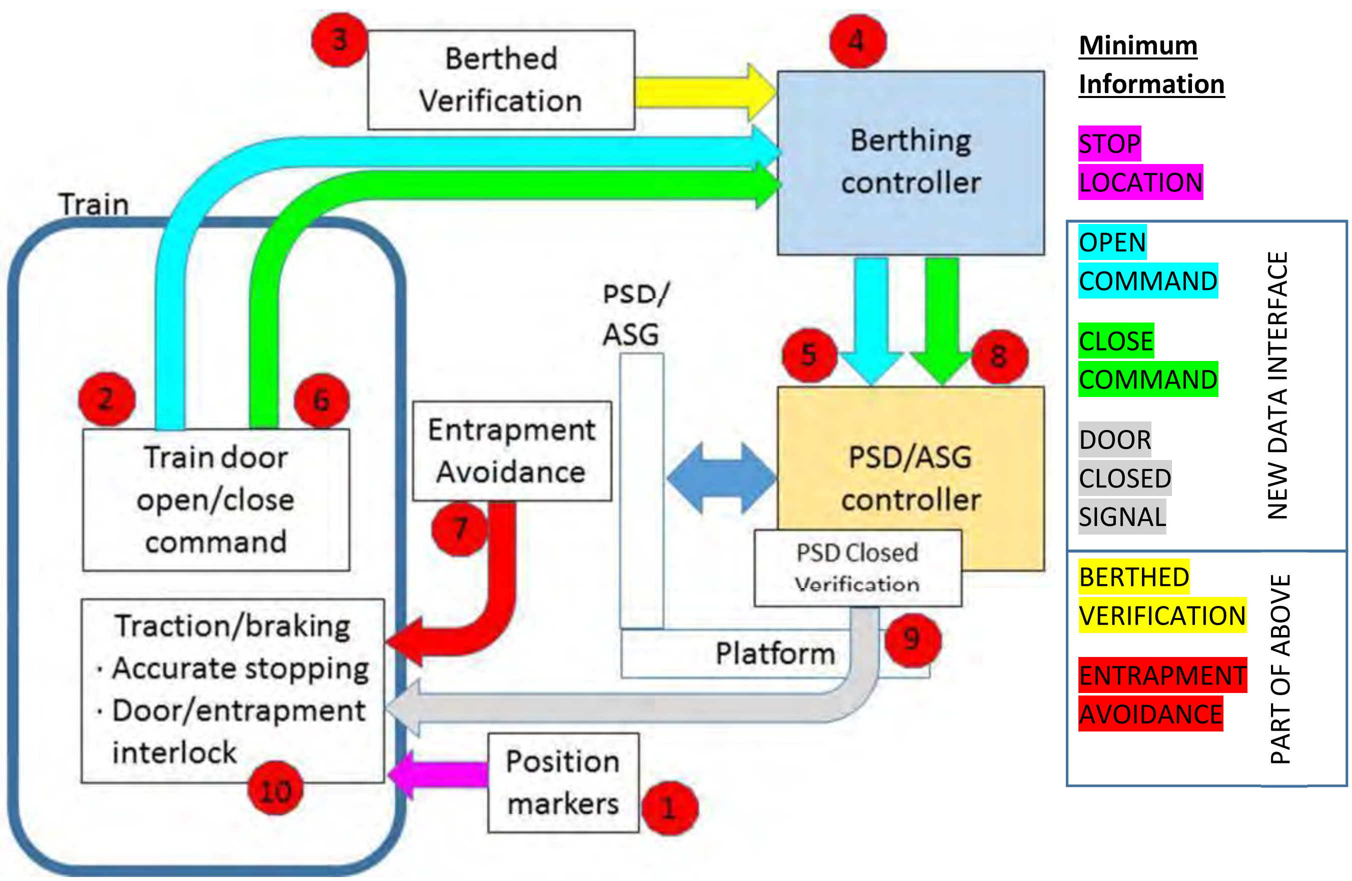
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

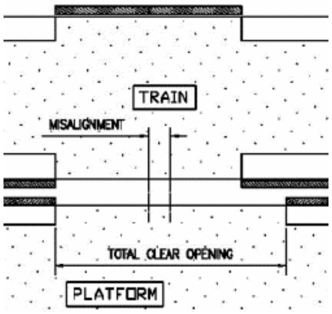
C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5” clear opening, a design for NY should meet the ADA Accessibility Guideline of 36”.

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a ‘distance totem’ which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy’s COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically

If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.

For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4’-0”). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

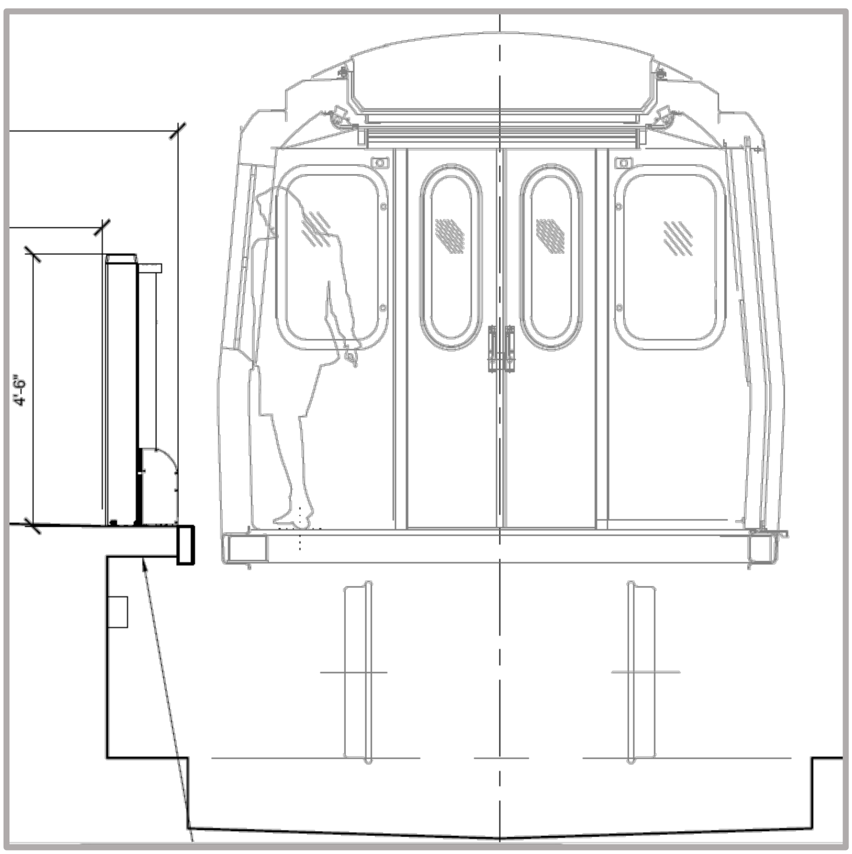


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

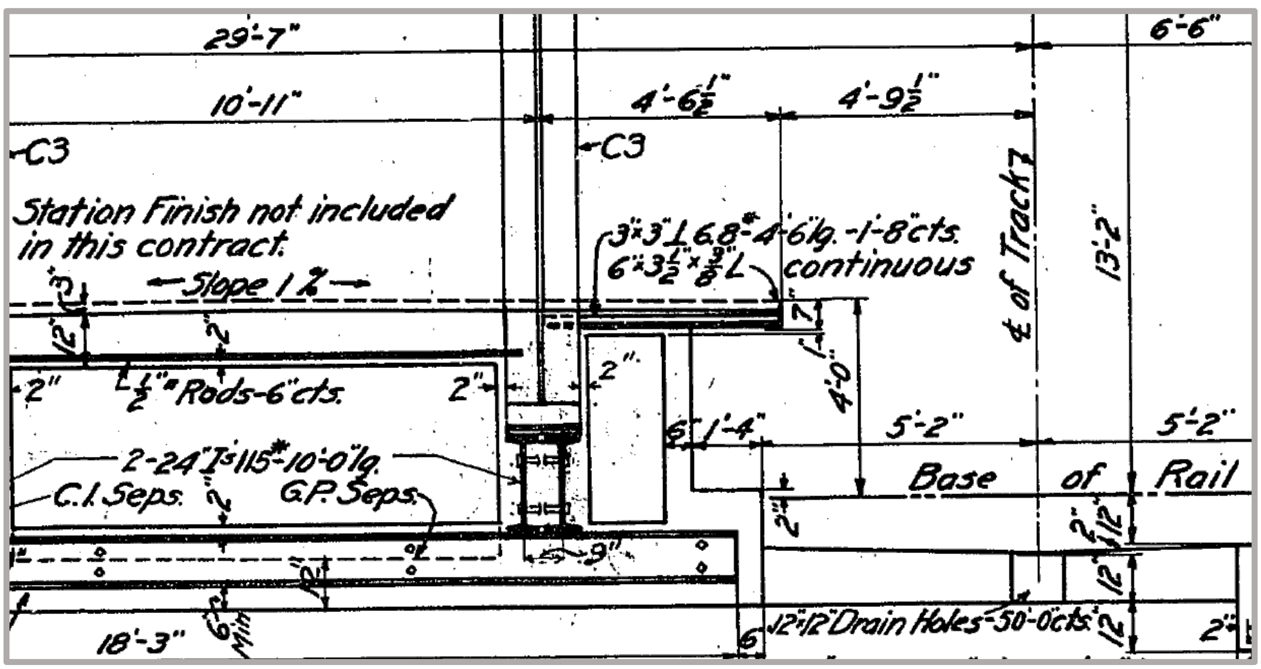


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

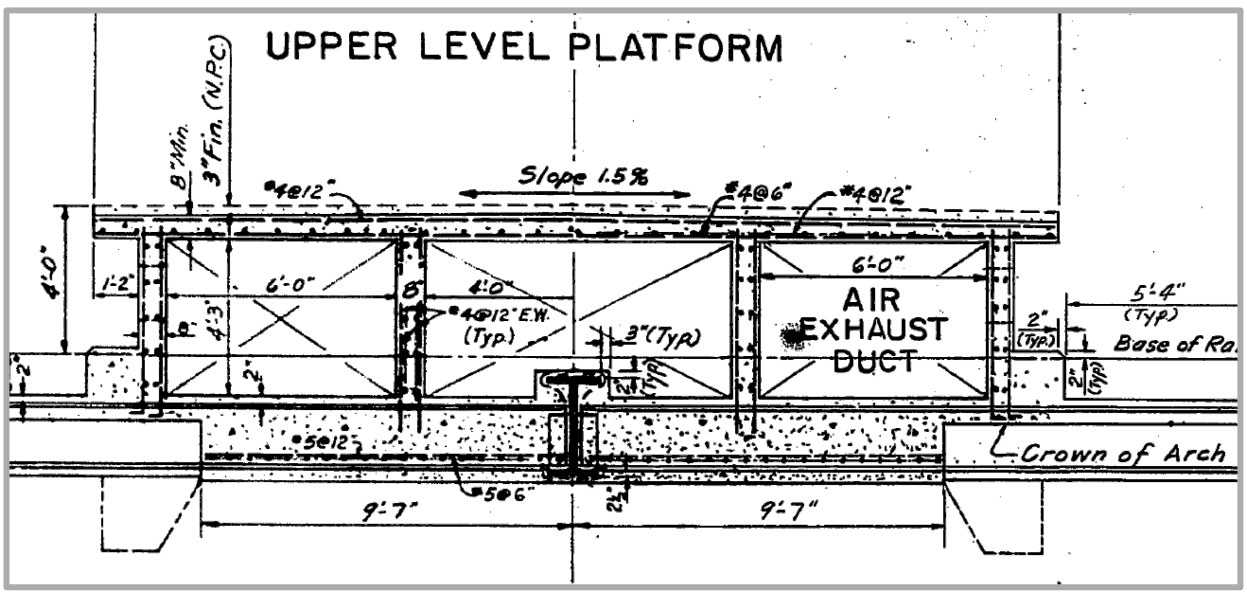


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

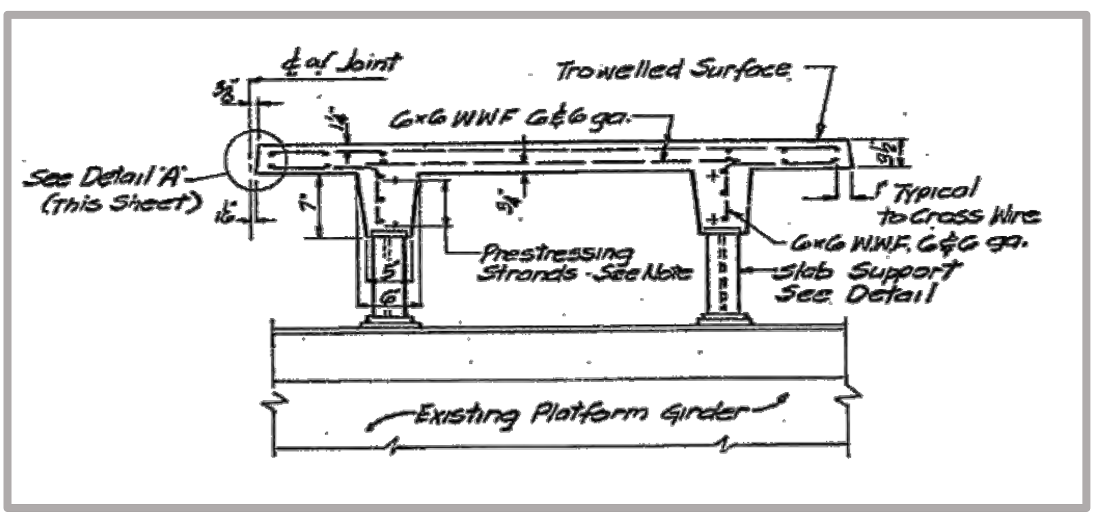


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

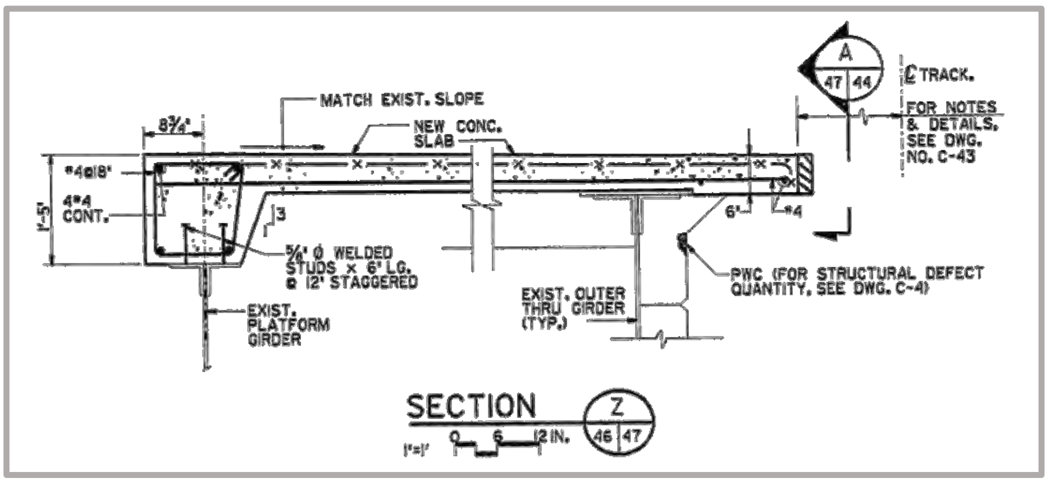


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2'-9"), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

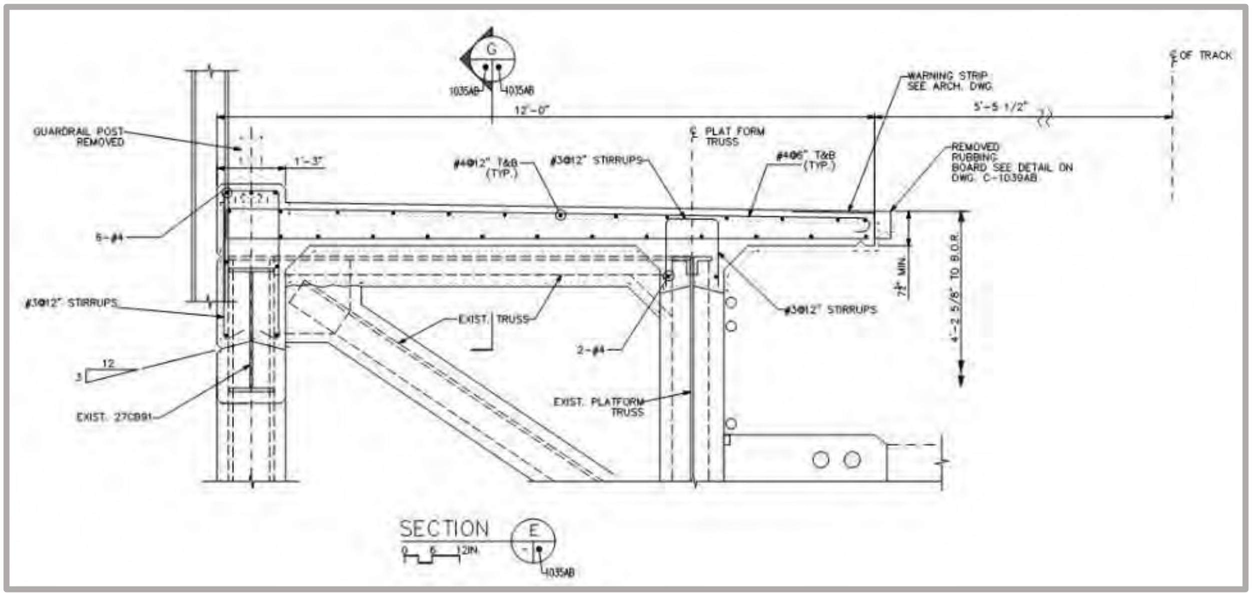


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3" thick structural slab with an approximately 3" thick topping slab. If the topping slab is fully removed, a 6" thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6" thick slab will be sufficient for a cantilever length of up to approximately 3'-0", greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6" structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6" minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

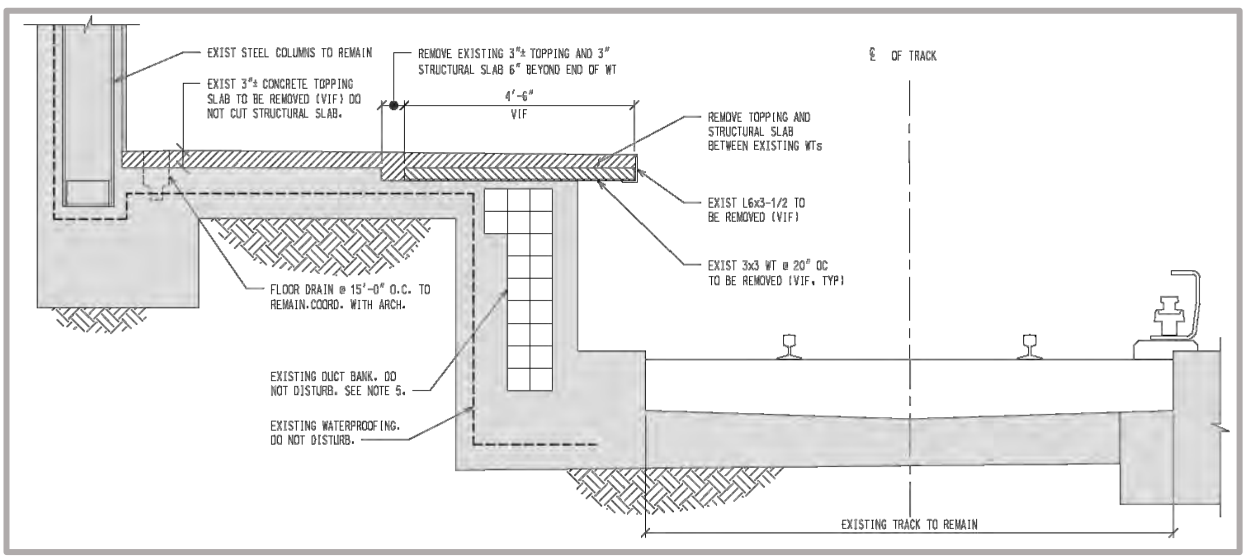


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

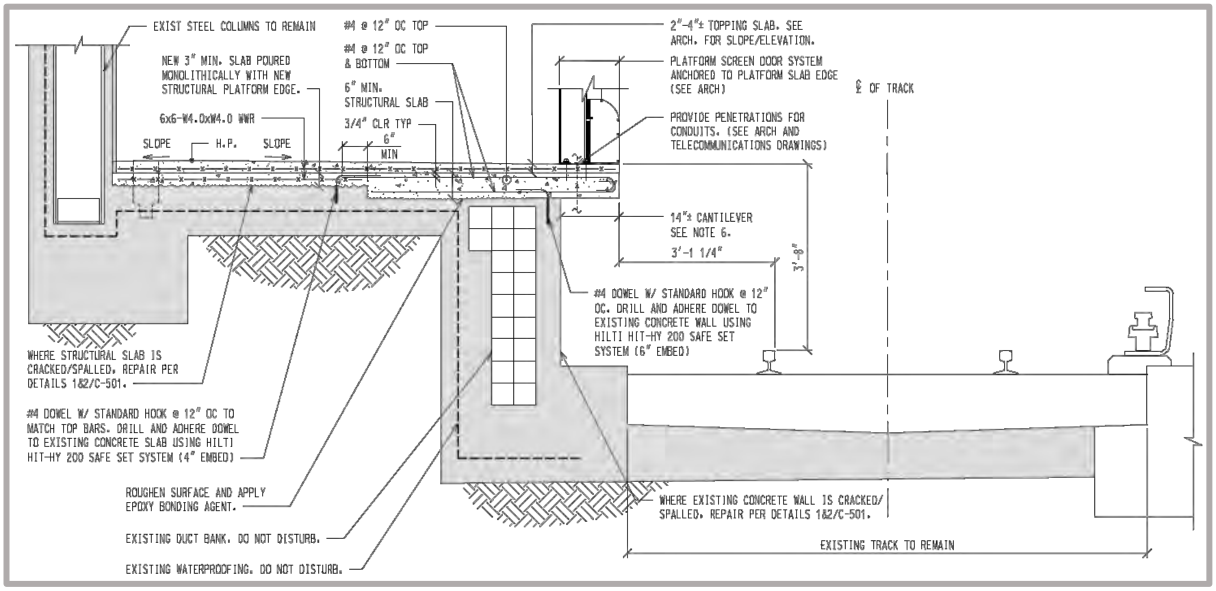


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

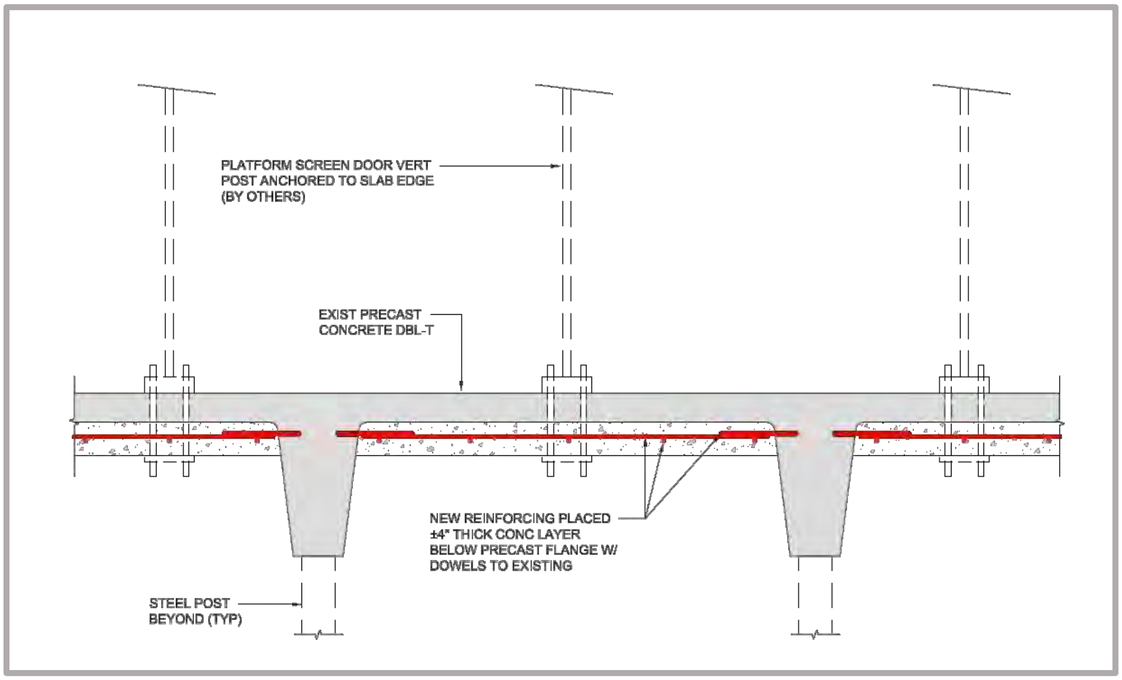


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5' – 11" of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis

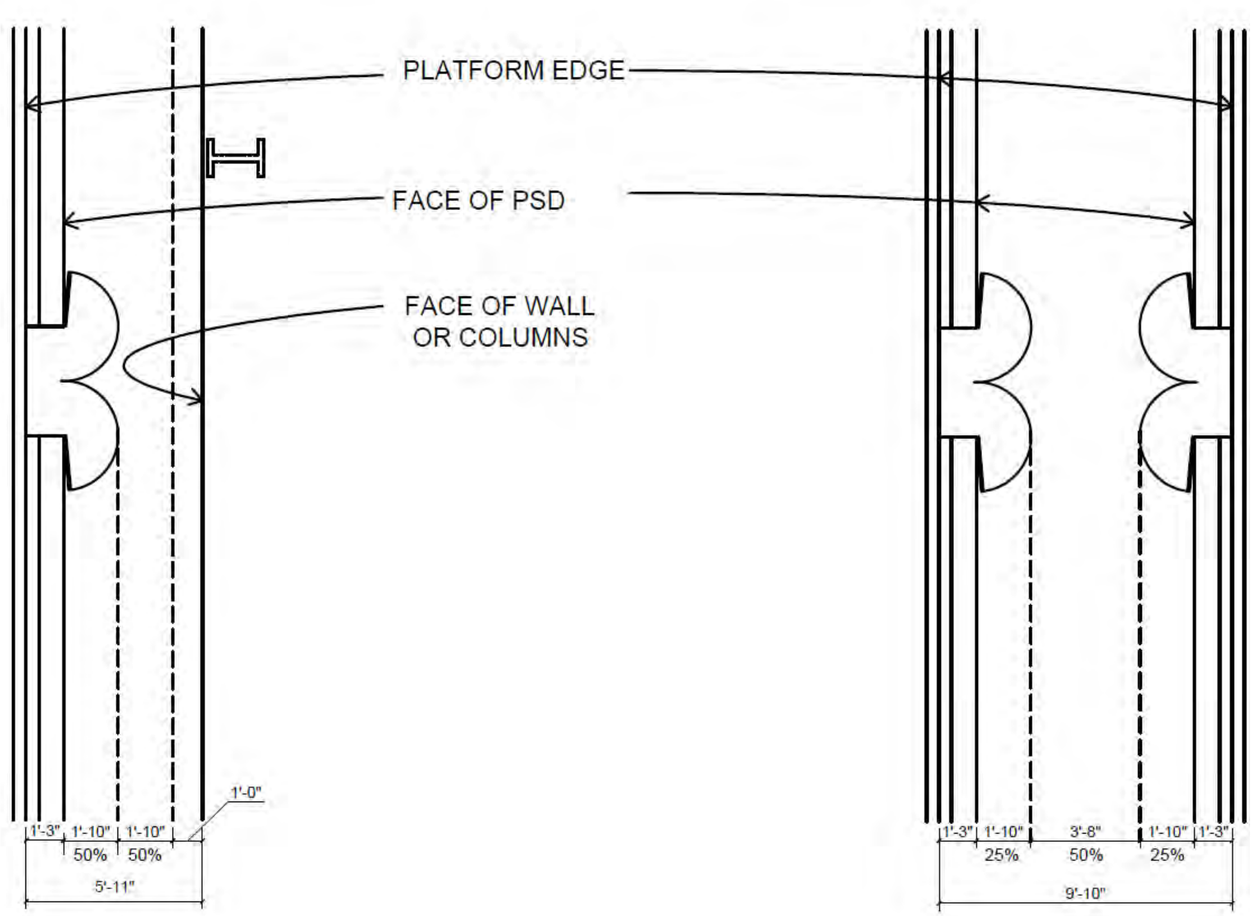


FIGURE 1: SIDE PLATFORM

FIGURE 2: CENTER PLATFORM

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

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MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	9	$ 63,500 per month [Year 01]	$ 571,500		
		12	$ 83,590 per month [Year 02]	$ 1,003,080		
		12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment.	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
		12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663		

ITEM NO.	DESCRIPTION		RATE
7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *
		Year 3	$ 257 per hour *
	Optional :	Year 4	$ 268 per hour *
	Optional :	Year 5	$ 278 per hour *

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations
ESTIMATE DATE:	June 3, 2019

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

MTA/NYCT

June 3, 2019

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.2 *APGs / PSDs will provide 39 emergency egress doors with push bars per platform*
1.3 *Each platform edge will have 50 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 It is assumed that each train has 10 cars on this line
2.2 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.3 In respect of the PSD option, only platforms that have not been upgraded in the recent past will require platform edge replacement.
2.4 There are no special security requirements made necessary by installation of the APG system
2.5 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.6 This estimate does not provide for the replacement of Platform Edge Lighting
2.7 Premium cost for night time work is considered 50% of total labor cost

3.0 ***Exclusions - Costs not included in the estimate:***

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

MTA/NYCT

June 3, 2019

BASIS OF ESTIMATE

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems
3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length
3.4 Costs associated with NYCT State Of Good Repair improvements to the station
3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.
3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs
3.7 Escalation Cost is not included; Anticipate at 5% per annum.
3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.
3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium
3.10 NYCT project cost is not included
3.11 GO and flagging cost is not included
3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or "soft" costs:***

4.1 Design and Construction Contingency
4.2 Contractor O & P
4.3 Insurance
4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 Given the limited time available, no drawings were developed to support this estimate.

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MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

June 3, 2019

	ORDER OF MAGNITUDE COSTS		MRN 049	MRN 053	MRN 157	MRN 058	MRN 223	MRN 277
	DESCRIPTION		135TH STREET	125TH ST. NICHOLAS AVE.	96TH STREET	174TH 175TH ST	167TH ST	7TH AVE
1	AUTOMATIC PLATFORM GATES (APG'S)		$16,235,686	$16,665,081	$16,338,296	$17,063,278	$16,897,033	$17,244,660
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$16,235,686	$16,665,081	$16,338,296	$17,063,278	$16,897,033	$17,244,660
4	GENERAL REQUIREMENTS	15.00%	$2,435,353	$2,499,762	$2,450,744	$2,559,492	$2,534,555	$2,586,699
	SUB-TOTAL:		$18,671,038	$19,164,843	$18,789,040	$19,622,770	$19,431,588	$19,831,360
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,667,760	$4,791,211	$4,697,260	$4,905,693	$4,857,897	$4,957,840
	SUB-TOTAL:		$23,338,798	$23,956,054	$23,486,300	$24,528,463	$24,289,485	$24,789,199
6	OVERHEAD & PROFIT	15.00%	$3,500,820	$3,593,408	$3,522,945	$3,679,269	$3,643,423	$3,718,380
	SUB-TOTAL:		$26,839,618	$27,549,462	$27,009,245	$28,207,732	$27,932,908	$28,507,579
7	BONDS & INSURANCE	3.75%	$1,006,486	$1,033,105	$1,012,847	$1,057,790	$1,047,484	$1,069,034
	SUB-TOTAL:		$27,846,104	$28,582,567	$28,022,092	$29,265,522	$28,980,392	$29,576,614
	SUBTOTAL CONSTRUCTION COST W/O ACM		$27,846,104	$28,582,567	$28,022,092	$29,265,522	$28,980,392	$29,576,614
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		$27,846,104	$28,582,567	$28,022,092	$29,265,522	$28,980,392	$29,576,614
10	DESIGN CONSULTANT FEES	10.00%	$2,784,610	$2,858,257	$2,802,209	$2,926,552	$2,898,039	$2,957,661
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		$30,630,714	$31,440,823	$30,824,301	$32,192,074	$31,878,432	$32,534,275
	ADD ALTERNATIVES							
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		4,631,954	5,307,455	4,150,151	4,472,714	4,354,544	$5,227,108
	Add for Markups (as above)	88.66%	4,106,824	4,705,743	3,679,644	3,965,637	3,860,864	4,634,505
	SUB-TOTAL PSD ALTERNATIVE		$8,738,778	$10,013,199	$7,829,795	$8,438,351	$8,215,408	$9,861,614
	TOTAL PROJECT COST (PSD OPTION)		$39,369,492	$41,454,022	$38,654,096	$40,630,425	$40,093,840	$42,395,889

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 135TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	598	LF		
5	LENGTH OF THE PLATFORM EDGE =	598	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,196**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,196	LF	7	8,372
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,980	SF	12	71,760
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	120	CY	2,500	300,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,198	EA	25	29,950
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,198	EA	25	29,950
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,196	LF	95	113,620
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,196	LF	15	17,940
26	Remove existing platform tiles	1,196	LF	12	14,352
27	Sawcut existing topping concrete at perimeter of removal area	1,196	LF	5	5,980
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,176	SF	8	57,408
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 5'-9" wide	460	SF	8	3,680
30	New Work				
31	New concrete topping to match existing	1,196	SF	15	17,940

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 135TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	460	SF	15	6,900
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,097	SF	750	1,572,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	221,025	221,025
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 135TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,196	LF	60	71,760
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 135TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,746,697	3,746,697
112					
113	TOTAL PSD WORK:				$ 16,235,686
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,702	SF	750	3,526,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	409,702	409,702
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	79,436
129	L6x6x1/2 continuous angle	9	TONS	17,500	154,045
130	Drilling and bolting - 4 bolts at each connection	478	EA	216	103,334
131	Platform Edge Repair				
132	Remove concrete platform edge	1,196	LF	27	32,292
133	Platform edge repair	1,196	LF	109	130,364
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	624	EA	10	6,240
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	80	HRS	162	12,960
137	Remove signal cables	600	LF	40	24,000
138	Remove conduit; Assuming 1"	600	LF	55	33,000
139	Install conduit in new position	600	LF	110	66,000
140	Install replacement cable; assumed single cable #12	600	LF	125	75,000
141	Allow for remove and reinstall conductor boxes	4	EA	3,000	12,000
142	Re-commission / testing as required	2	EA	12,500	25,000
143	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
144	Premium Time	1,644	HRS	49	79,898

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 135TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,097)	SF	750	(1,572,750)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	221,025	(221,025)
153	Platform Edge Reconstruction work	(1)	LS	546,860	(546,860)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,196)	LF	30	(35,880)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,068,912	1,068,912
158					
159	PREMIUM ASSOCIATED WITH PSD's				$ 4,631,954

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 125TH ST. NICHOLAS AVE.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	634	LF		
5	LENGTH OF THE PLATFORM EDGE =	634	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,268**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,268	LF	7	8,876
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,340	SF	12	76,080
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	128	CY	2,500	320,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,270	EA	25	31,750
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,270	EA	25	31,750
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,268	LF	95	120,460
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,268	LF	15	19,020
26	Remove existing platform tiles	1,268	LF	12	15,216
27	Sawcut existing topping concrete at perimeter of removal area	1,268	LF	5	6,340
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,608	SF	8	60,864
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 7'-0" wide	560	SF	8	4,480
30	New Work				
31	New concrete topping to match existing	1,268	SF	15	19,020

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 125TH ST. NICHOLAS AVE.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	560	SF	15	8,400
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,421	SF	750	1,815,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	235,605	235,605
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 125TH ST. NICHOLAS AVE.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,268	LF	60	76,080
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	300	LF	60	18,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	350	LF	60	21,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 125TH ST. NICHOLAS AVE.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,845,788	3,845,788
112					
113	TOTAL PSD WORK:				$ 16,665,081
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,278	SF	750	3,958,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	435,622	435,622
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	84,140
129	L6x6x1/2 continuous angle	9	TONS	17,500	163,318
130	Drilling and bolting - 4 bolts at each connection	507	EA	216	109,555
131	Platform Edge Repair				
132	Remove concrete platform edge	1,268	LF	27	34,236
133	Platform edge repair	1,268	LF	109	138,212
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	624	EA	10	6,240
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	160	HRS	162	25,920
137	Remove signal cables	1,200	LF	40	48,000
138	Remove conduit; Assuming 1"	1,200	LF	55	66,000
139	Install conduit in new position	1,200	LF	110	132,000
140	Install replacement cable; assumed single cable #12	1,200	LF	125	150,000
141	Allow for remove and reinstall conductor boxes	2	EA	3,000	6,000
142	Re-commission / testing as required	4	EA	12,500	50,000
143	Engineering / Shop Drawings / Etc.	4	EA	7,500	30,000
144	Premium Time	3,175	HRS	49	154,305

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 125TH ST. NICHOLAS AVE.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,421)	SF	750	(1,815,750)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	235,605	(235,605)
153	Platform Edge Reconstruction work	(1)	LS	574,780	(574,780)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,268)	LF	30	(38,040)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,224,797	1,224,797
158					
159	PREMIUM ASSOCIATED WITH PSD's				$ 5,307,455

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STATION : 96TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE UPPER PLATFORM EDGE=	614	LF		
5	LENGTH OF THE LOWER PLATFORM EDGE =	614	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,228**	**LF**		
7	NUMBER OF TRAIN CARS ON W TRAIN TRACK =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,228	LF	7	8,596
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,140	SF	12	73,680
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,230	EA	25	30,750
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,230	EA	25	30,750
19	Cast in assemblies for PSD holding down bolts	320	EA	180	57,600
20	Polyethylene edge strip	1,228	LF	95	116,660
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,228	LF	15	18,420
26	Remove existing platform tiles	1,228	LF	12	14,736
27	Sawcut existing topping concrete at perimeter of removal area	1,228	LF	5	6,140
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,368	SF	8	58,944
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 5'-11" wide	473	SF	8	3,787
30	New Work				
31	New concrete topping to match existing	1,228	SF	15	18,420

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 96TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	473	SF	15	7,100
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,241	SF	750	1,680,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	227,505	227,505
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 96TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,228	LF	60	73,680
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 96TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,770,376	3,770,376
112					
113	TOTAL PSD WORK:				$ 16,338,296
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,958	SF	750	3,718,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	421,222	421,222
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,527
129	L6x6x1/2 continuous angle	9	TONS	17,500	158,166
130	Drilling and bolting - 4 bolts at each connection	491	EA	216	106,099
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 96TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,241)	SF	750	(1,680,750)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	227,505	(227,505)
152	Platform Edge Reconstruction work	(1)	LS	502,780	(502,780)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,228)	LF	30	(36,840)
155					
156	Allow loss of production to work at night say 50%	1	LS	957,727	957,727
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,150,151

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 174TH 175TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	671	LF		
5	LENGTH OF THE PLATFORM EDGE =	671	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,342**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,342	LF	7	9,394
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,710	SF	12	80,520
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	135	CY	2,500	337,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,344	EA	25	33,600
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,344	EA	25	33,600
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,342	LF	95	127,490
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,342	LF	15	20,130
26	Remove existing platform tiles	1,342	LF	12	16,104
27	Sawcut existing topping concrete at perimeter of removal area	1,342	LF	5	6,710
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,052	SF	8	64,416
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 8'-7" wide	687	SF	8	5,493
30	New Work				
31	New concrete topping to match existing	1,342	SF	15	20,130

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 174TH 175TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	687	SF	15	10,300
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,754	SF	750	2,065,500
61	Spare Parts - Approx. 10% of Material Cost	1	LS	250,590	250,590
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 174TH 175TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,342	LF	60	80,520
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	250	LF	60	15,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	300	LF	60	18,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 174TH 175TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,937,680	3,937,680
112					
113	TOTAL PSD WORK:				$ 17,063,278
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,870	SF	750	4,402,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	462,262	462,262
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	88,974
129	L6x6x1/2 continuous angle	10	TONS	17,500	172,850
130	Drilling and bolting - 4 bolts at each connection	537	EA	216	115,949
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 174TH 175TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,754)	SF	750	(2,065,500)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	250,590	(250,590)
152	Platform Edge Reconstruction work	(1)	LS	600,420	(600,420)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,342)	LF	30	(40,260)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,032,165	1,032,165
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,472,714

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 167TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	659	LF		
5	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	659	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,318**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,318	LF	7	9,226
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,590	SF	12	79,080
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,320	EA	25	33,000
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,320	EA	25	33,000
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,318	LF	95	125,210
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,318	LF	15	19,770
26	Remove existing platform tiles	1,318	LF	12	15,816
27	Sawcut existing topping concrete at perimeter of removal area	1,318	LF	5	6,590
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,908	SF	8	63,264
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 5'-9" wide	460	SF	8	3,680
30	New Work				
31	New concrete topping to match existing	1,318	SF	15	19,770
32	New concrete topping at ADA boarding area to match existing	460	SF	15	6,900

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 167TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [12'-0" x 16'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,646	SF	750	1,984,500
61	Spare Parts - Approx. 10% of Material Cost	1	LS	245,730	245,730
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
71	Allow for conduit / cable runs for power and communications under platform edge	1,318	LF	60	79,080

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 167TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
74	Power to PSD Room from EDR including track crossing if needed	100	LF	60	6,000
75	Reserve power to PSD Room from EDR including track crossing if needed	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
79	MISC				
80	Testing and commissioning	1	LS	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 167TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,899,315	3,899,315
113	TOTAL PSD WORK:				$ 16,897,033

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,678	SF	750	4,258,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	453,622	453,622
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	87,406
129	L6x6x1/2 continuous angle	10	TONS	17,500	169,758
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 167TH ST

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
145	**OMIT**				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,646)	SF	750	(1,984,500)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	245,730	(245,730)
152	Platform Edge Reconstruction work	(1)	LS	592,780	(592,780)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,318)	LF	30	(39,540)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,004,895	1,004,895
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				**4,354,544**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 7TH AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE UPPER PLATFORM EDGE [SOUTH BOUND] =	658	LF		
5	LENGTH OF THE LOWER PLATFORM EDGE [NORTH BOUND] =	658	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,315**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,315	LF	7	9,205
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,575	SF	12	78,900
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	132	CY	2,500	330,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,317	EA	25	32,925
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,317	EA	25	32,925
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,315	LF	95	124,925
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,315	LF	15	19,725
26	Remove existing platform tiles	1,315	LF	12	15,780
27	Sawcut existing topping concrete at perimeter of removal area	1,315	LF	5	6,575
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,890	SF	8	63,120
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,315	SF	15	19,725

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 7TH AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room Upper Platform Level [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,633	SF	750	1,974,375
61	Spare Parts - Approx. 10% of Material Cost	1	LS	245,123	245,123
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 7TH AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,315	LF	60	78,900
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	650	LF	60	39,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	700	LF	60	42,000
76	Allowance for power to cross tracks to opposite platform [Upper level]	1	LS	15,000	15,000
77	Allowance for power to cross tracks to opposite platform [Lower level]	1	LS	15,000	15,000
78	No allowance for new lighting as if APG's are used		Note		EXCL.
79	Grounding				
80	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
81	MISC				
82	Testing and commissioning	1	EA	30,000	30,000
83	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
84					
85	**Communications**				
86	FA System				
87	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
88	CCTV coverage				
89	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
90	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
91	Berthing Technology Sensors				
92	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
93	Train Door Detection System				
94	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
95	Entrapment concerns				
96	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
97	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
98	Engineering and Testing	2,000	Hrs	160	319,860
99	Centralized monitoring/control				
100	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 7TH AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
101	MISC				
102	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
103	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
104	Site Survey and Inspections	1	LS	100,000	100,000
105	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
106	Furnish Test Equipment allowance	1	LS	500,000	500,000
107	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
108					
109	**Training**				
110	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
111					
112	**Out of hours Work**				
113	Allow loss of production to work at night say 50%	1	LS	3,979,537	3,979,537
115	**TOTAL PSD WORK:**				**$ 17,244,660**

117					
118	ADD ALTERNATIVE				
119					
120	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
121					
122	ADD				
123	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
124	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
125	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
126	Platform End Gates (PEGs)	4	EA	18,000	72,000
127	Fixed Panels including framing and support; Assuming 8'-0" high	5,654	SF	750	4,240,365
128	Spare Parts - Approx. 10% of Material Cost	1	LS	452,542	452,542
129	Structual framing / bracing				
130	HSS4x4x1/2 hanger	5	TONS	17,500	87,210
131	L6x6x1/2 continuous angle	10	TONS	17,500	169,372
132	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
133	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long	1	LS	350,000	350,000
134	Platform Edge Repair				
135	Remove concrete platform edge				Previously done
136	Platform edge repair				Previously done
137	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
138	Signal Work [Each 300' length is associated with one signal light]				
139	Disconnects	80	HRS	162	12,960
140	Remove signal cables	600	LF	40	24,000
141	Remove conduit; Assuming 1”	600	LF	55	33,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for B - Line Stations

3-Jun-19

STATION : 7TH AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
142	Install conduit in new position	600	LF	110	66,000
143	Install replacement cable; assumed single cable #12	600	LF	125	75,000
144	Re-commission / testing as required	2	EA	12,500	25,000
145	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
146	Premium Time	1,569	HRS	49	76,253
147					
148	OMIT				
149	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
150	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
151	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
152	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
153	Fixed Panels including framing and support; 4'-6" High	(2,633)	SF	750	(1,974,375)
154	Spare Parts - Approx. 10% of Material Cost	(1)	LS	245,123	(245,123)
155	Platform Edge Reconstruction work	(1)	LS	589,950	(589,950)
156	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
157	Conduit running under Platform Edge	(1,315)	LF	30	(39,450)
158					
159	Allow loss of production to work at night say 50%	1	LS	1,206,256	1,206,256
160					
161					
162	**PREMIUM ASSOCIATED WITH PSD's**				**5,227,108**

MTA New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR ‘’ SERVICE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

FINAL SUBMITTAL DATE: June 7, 2019

STV 100 Years

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Appendices

Appendix A: Tier 2-3 Technology Assessment
Appendix B: Structural Feasibility Report
Appendix C: Emergency Egress Width Analysis
Appendix D: Maintenance Cost Estimate
Appendix E: Rough Order of Magnitude Costs

Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. Our Tier 1 analysis found no instances of door misalignment between car classes for this line. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 41 newly evaluated stations, 36 have been found to be not suitable for the installation of PSDs.

[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to half-height barriers]

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues: the platform edge barriers are 15" wide. Where an existing object (wall, stair, and railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Under the following conditions, PSDs are declared infeasible:
  - Limit the ability of a wheelchair to turn within a 5'-0" circle
  - Limit path of travel to less than a 32" pinch width (defined as an obstruction that measures less than 2'-0" longitudinally, i.e. columns)
  - Limit path of travel to be less than a 36" corridor as defined by the edge of a staircase, railing or room
- Insufficient space for the PSD equipment room: the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow: due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements regarding the placement of these new barriers in an existing station environment.
- Structural considerations: existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.
- Columns at platform edge: at certain stations, the columns are positioned 16" to 24" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space.

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the previously proposed 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the PSD barriers and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is used for refuse removal at most of the D-line stations. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the (off) loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in damage from these carts along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process.

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 12% of the 'D' Line Stations. Total implementation cost would be \$159.4M for APGs and \$204.5M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; that estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of \$931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 5 feasible stations, the aggregate annual maintenance cost would be \$4.6M.

Summary Table

(12% Feasible 5/41)

MRN No.	Station Names	Station Type	Platform Type	Feasibility	Issues/Reason for Failure	Cost APGs	Cost PSDs
26	Dekalb Avenue Flatbush Ave	SUB	Island	No	ADA Clearance		
27	Atlantic Ave. Barclays Ctr.	SUB	Island	Yes	-	$ 31.4 M	$ 39.9 M
28	Union St.	SUB	Side	No	No PSD Room Location	-	-
29	9th Street 4th Ave	SUB	Side	No	No PSD Room Location	-	-
30	Prospect Avenue	SUB	Side	No	No PSD Room Location	-	-
31	25th Street	SUB	Side	No	No PSD Room Location	-	-
32	36th Street	SUB	Island	No	No PSD Room Location	-	-
58	Coney Island Stillwell / Surf	VIA	Island	No	Non-Compliant Egress	-	-
59	9th Avenue 39th St.	ELV	Island	No	ADA Clearance	-	-
60	Fort Hamilton Parkway	ELV	Side	No	Precast Platform	-	-
61	50th Street	ELV	Side	No	Precast Platform	-	-
62	55th Street	ELV	Side	No	Precast Platform	-	-
63	62nd Street	ELV	Island	No	Precast Platform	-	-
64	71st Street	ELV	Side	No	Precast Platform	-	-
65	79th Street	ELV	Side	No	Precast Platform	-	-
66	18th Avenue	ELV	Side	No	Precast Platform	-	-
67	20th Avenue	ELV	Side	No	Precast Platform	-	-
68	Bay Parkway	ELV	Island	No	Precast Platform	-	-
69	25th Avenue	ELV	Side	No	Precast Platform	-	-
70	Bay 50th Street	ELV	Side	No	Precast Platform	-	-
151	145th Street St. Nicholas	SUB	Island	No	ADA Clearance	-	-
153	125th Street St. Nicholas	SUB	Island	Yes	-	$ 31.4 M	$ 41.5 M
161	59th Street Columbus Circle	SUB	Island	No	ADA Clearance	-	-
167	West 4th St.	SUB	Island	No	Car Misalignment	-	-
210	205th Street Norwood	SUB	Island	TBD	ADA Clearance	-	-
211	Bedford Park Blvd.	SUB	Island	No	ADA Clearance	-	-
212	Kingsbridge Road	SUB	Island	No	ADA Clearance	-	-
213	Fordham Road	SUB	Island	No	ADA Clearance	-	-
214	182nd 183rd Sts.	SUB	Side	No	ADA Clearance	-	-
215	Tremont Avenue	SUB	Island	No	ADA Clearance	-	-
216	174th 175th St.	SUB	Side	Yes	-	$ 32.2 M	$ 40.6 M
217	170th Street	SUB	Side	No	ADA Clearance	-	-
218	167th Street	SUB	Side	Yes	-	$ 31.9 M	$ 40.1 M
219	161st Street Yankee Stadium	SUB	Side	No	ADA Clearance	-	-
220	155th Street 8th Ave	SUB	Side	No	ADA Clearance	-	-
225	47th 50th Street Rockefeller	SUB	Island	No	Car Misalignment	-	-
226	42nd Street Bryant Pk	SUB	Island	No	Car Misalignment	-	-
227	34th Street Herald Sq.	SUB	Island	No	Car Misalignment	-	-
230	Broadway / Lafayette	SUB	Island	No	Car Misalignment	-	-
231	Grand Street Chrystie St.	SUB	Side	No	ADA Clearance	-	-
277	7th Avenue	SUB	Island	Yes	-	$ 32.5 M	$ 42.4 M
						$ 159.4 M	**$ 204.5 M**

1.0 Station Assessments

1.01 – MR 026 | Dekalb Avenue Station

Summary: *Dekalb Ave Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 29" (see figure 1).*

Description

Dekalb Ave Station is a below-grade station with two center / island platforms. The platform structures are cast-in-place concrete. The platform columns are spaced 10'-10" on center, and column faces typically measure 3'-8" from the platform edge. The platform width is 15'-8" throughout. At the platform staircases, the columns flanking the stairs measure 3'-8" from the platform edge and are touching the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 44" to 29" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

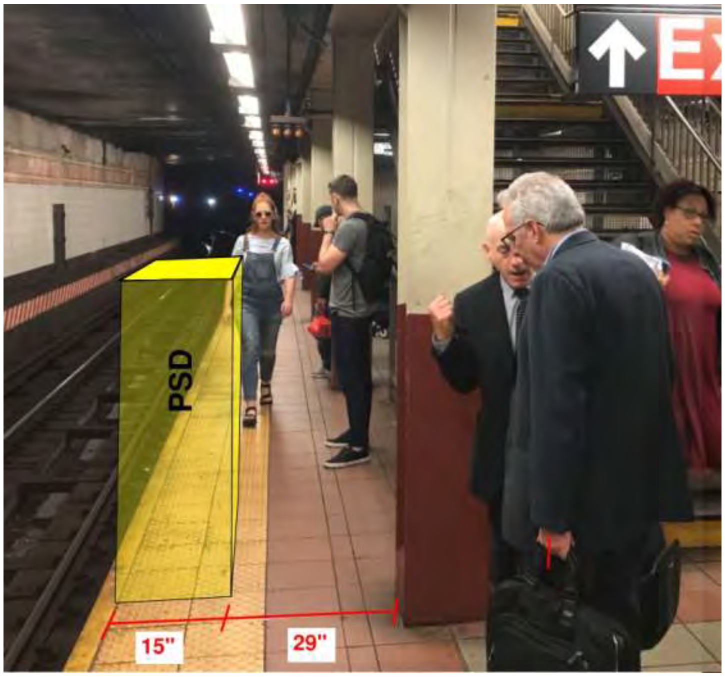

Figure 1 *– Non-Compliant ADA condition Dekalb Avenue Station*

1.02 – MR 027 | Atlantic Avenue/ Barclays Center Station

Summary: *Atlantic Ave Station is feasible for both APGs and PSDs. At the southbound platform, two columns adjacent to the platform edge would require removal and replacement at a more distant location. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Atlantic Ave Station is a below grade with two center / island platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. The platform columns are spaced 15' on center, and column faces are at varying distances from the platform edge. The platform width is 18'-8" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

Since there are 4 platform edges at this station, 2 full size equipment rooms would be required. Both equipment rooms could be located at the south mezzanine. (**Figure 1 & Figure 2).** The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

This platform edge was re-constructed within the last thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system.

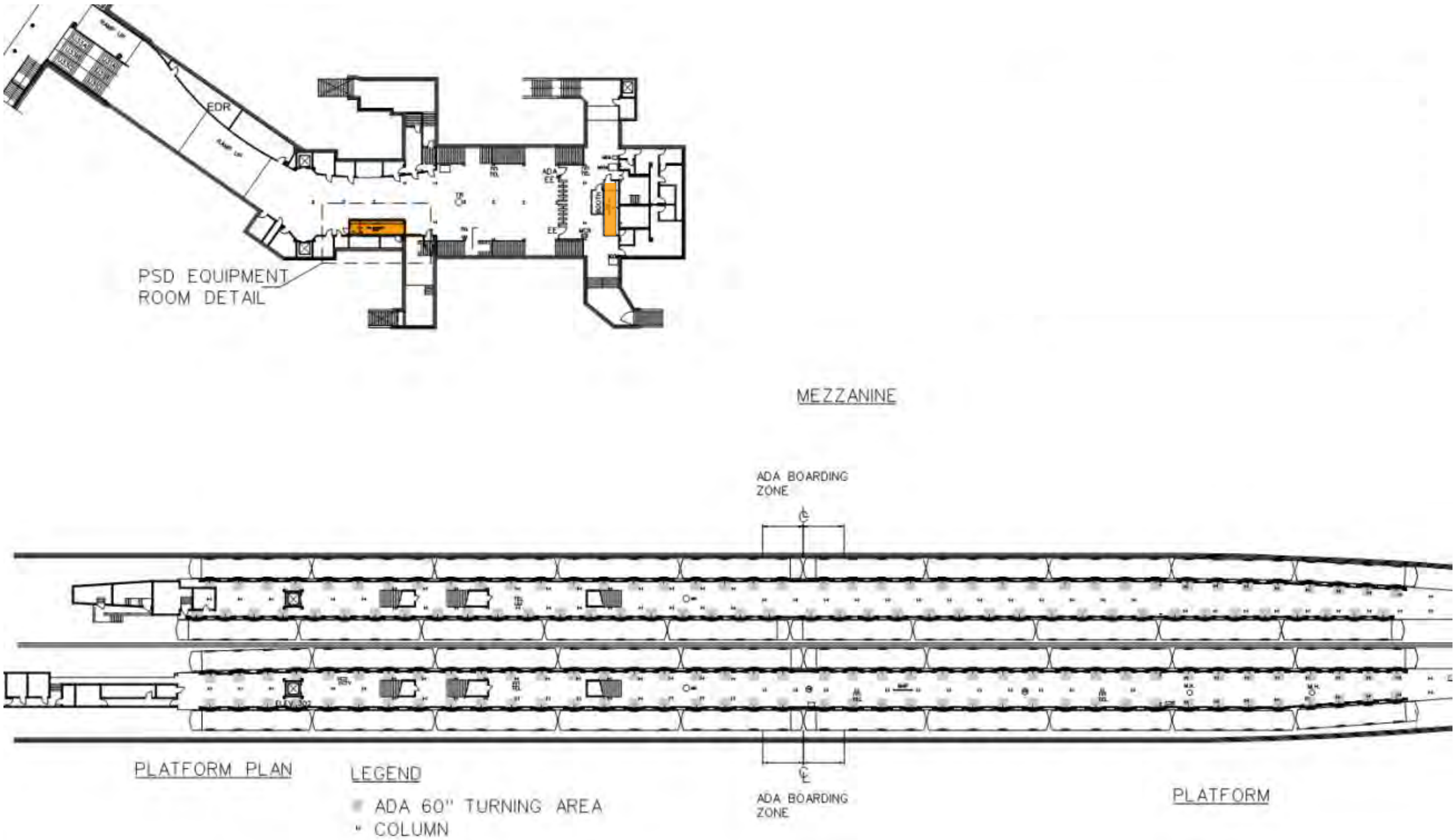

***Figure 1** – Overall Station Plan*
Atlantic Ave Station

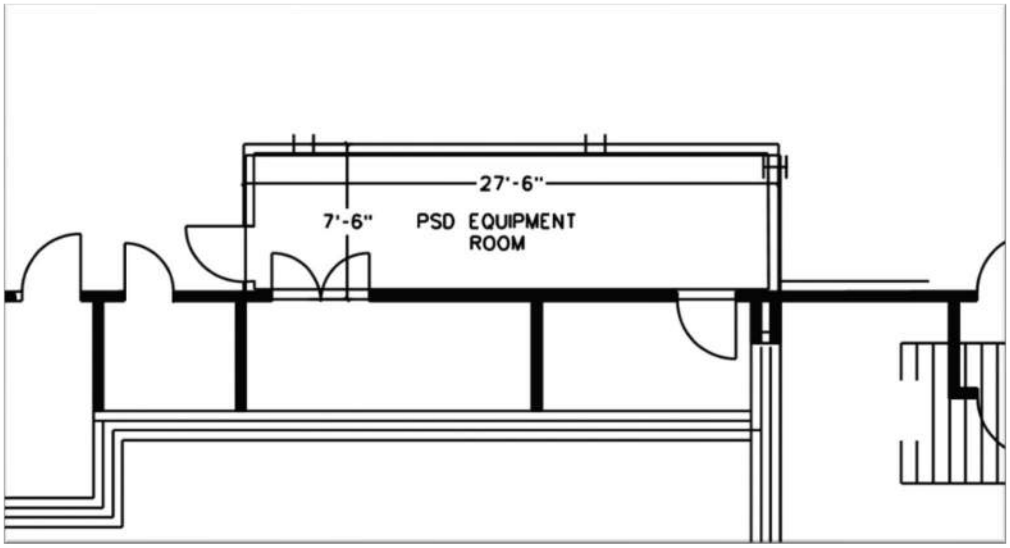

Figure 2 *– PSD Equipment Room 1 Detail*
Atlantic Ave Station

Platform obstructions within 5' of edge:

Southbound Track:

- One column is at 1'-0" from each platform edge. They will require removal and replacement as part of any PSD installation.

Northbound Track:

- None

These obstructions do not present an impediment to the installation of PSDs beyond the instances mentioned above.

Historic Restrictions:

The Atlantic Avenue station is a historically designated property. As such, design will require review by the New York State Historical Preservation Office.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Atlantic Ave. Barclays Ctr.
Peak Demand Load from ConEd Report, (kW)	88.8
Apparent Power (kVA)	111.0
Station Peak Demand Load, Max Current, (A)	308.3
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	649
Station Service Power Capacity, (Main SB or SG Rating), (A)	1600
Service Spare Capacity, (A)	951
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 1600A fuses at Service switch. Station has (2) separate meter readings each for Normal & Reserve service.

***Table 1**- Power Capacity Analysis (Normal Service)*

Station Power Capacity Analysis (Reserve Service)

NYCT Station MR Number	27
Station Name	Atlantic Ave. Barclays Ctr.
Peak Demand Load from ConEd Report, (kW)	55.2
Apparent Power (kVA)	69.0
Station Peak Demand Load, Max Current, (A)	191.7
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	532
Station Service Power Capacity, (Main SB or SG Rating), (A)	1600
Service Spare Capacity, (A)	1068
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 1600A fuses at Service switch. Station has (2) separate meter readings each for Normal & Reserve service.

***Table 1**- Power Capacity Analysis (Reserve Service)*

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.4M to install APGs and $39.9M to install PSDs (See Appendix E).

***Figure 3** – View of column at platform edge requiring removal and replacement*
Atlantic Ave Station

1.03 – MR 028 | Union Street / 4th Avenue Station

Summary: *Union Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

Union Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns 2'-6" from the platform edge at each platform at the northern third of the station. The remainder of the platforms is column-free. The platform width is 8'-8" throughout. Due to the extremely limited width of the existing platforms and control areas, there is no available space for the equipment room. Figure 2 below shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the northbound control area. The southbound control area is similar.

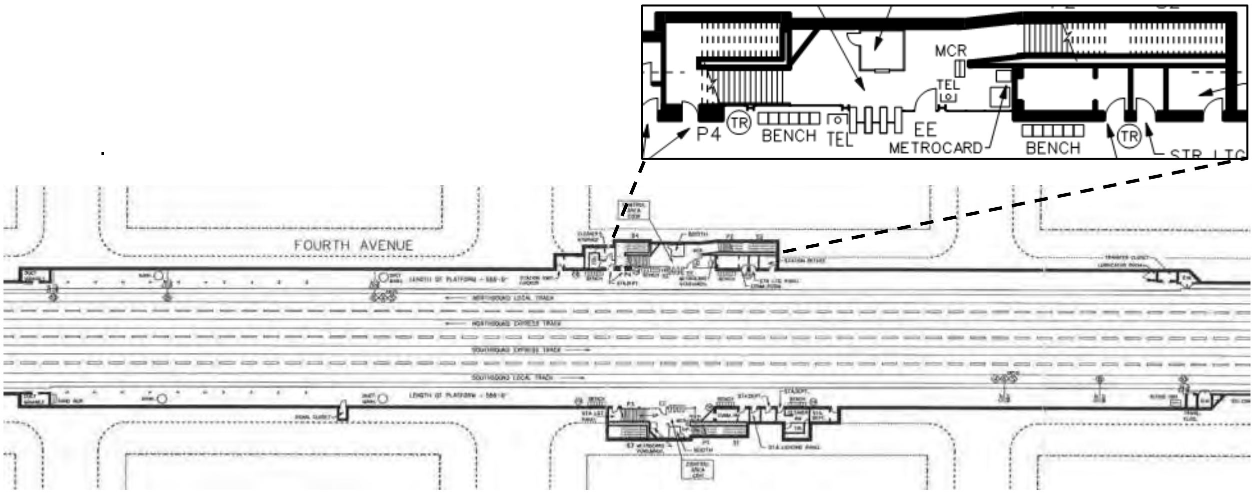

Figure 1 – *Congested/Narrow Station Plan*
Union Street Station

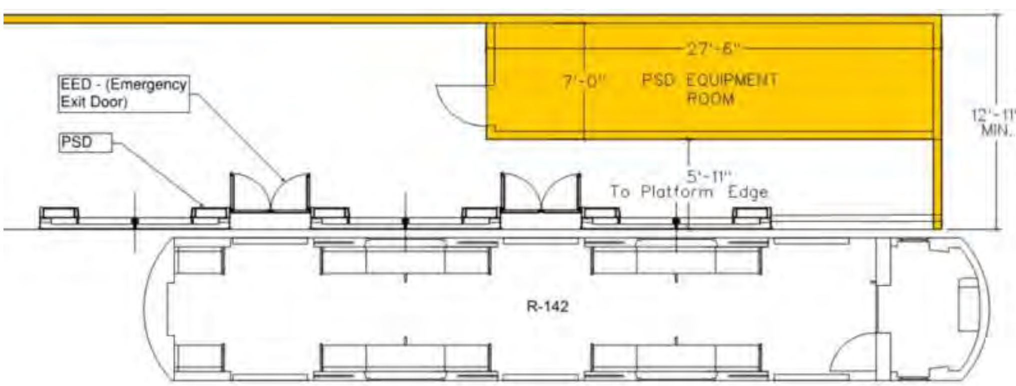

Figure 2 – *Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimensions

1.04 – MR 029 | 4th Avenue/ 9th Street Station

Summary: *4th Ave / 9th St Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

4th Ave / 9th St Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 8'-4" to 8'-8"." Columns are spaced 11'-10" on center with column faces 3'-0" away from the edge. The columns are present only on the northern third of both the platforms; the remainder of the platforms are column-free. Due to the extremely limited width of the existing platforms and control areas, there is no available space for the equipment room. Figure 2, below, shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the northbound control area. The southbound control area is similar.

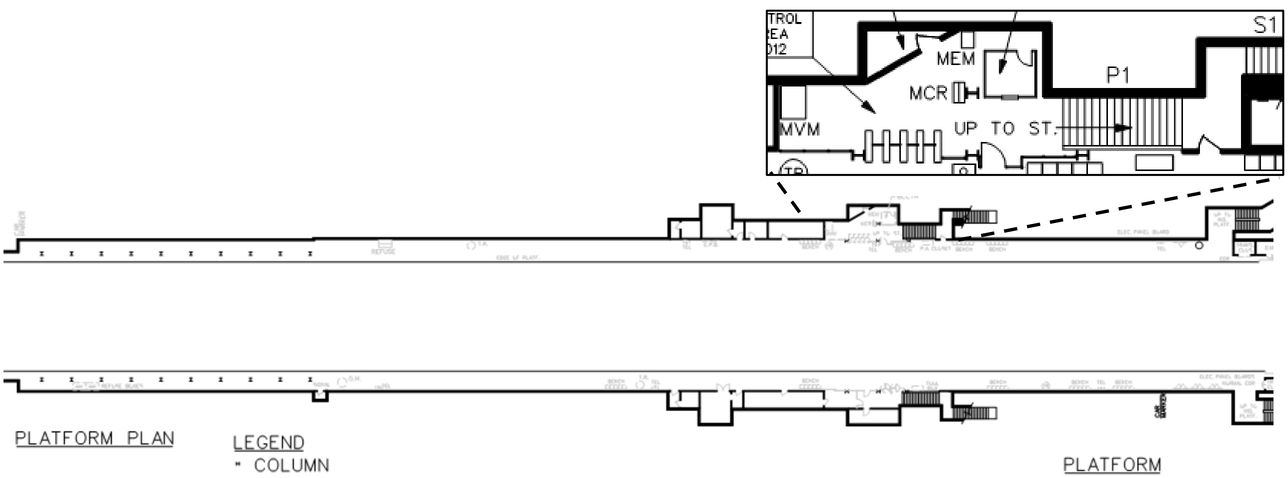

***Figure 1 –** Congested/Narrow Station Plan*
4th Ave / 9th Street Station

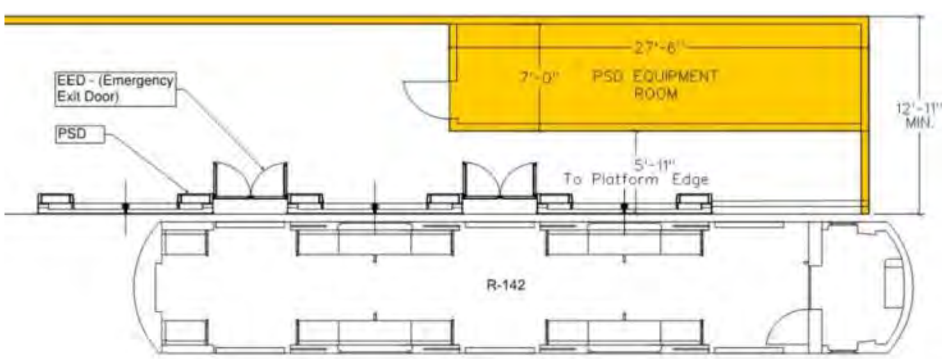

***Figure 2 –** Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimensions)

1.05 – MR 030 | Prospect Avenue Station

Summary: *Prospect Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

The Prospect Ave Station is a below-grade station with two side platforms. The platform structure is cast-in-place concrete. The width of the platforms is approximately 8'-4" throughout. Columns occupy only the northern third of the platforms with column faces 2'-4" away from the platform edge. Due to the extremely limited width of the existing platforms and control areas, there is no available space for an equipment room. Figure 2, below, shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the northbound control area. The southbound control area is similar.

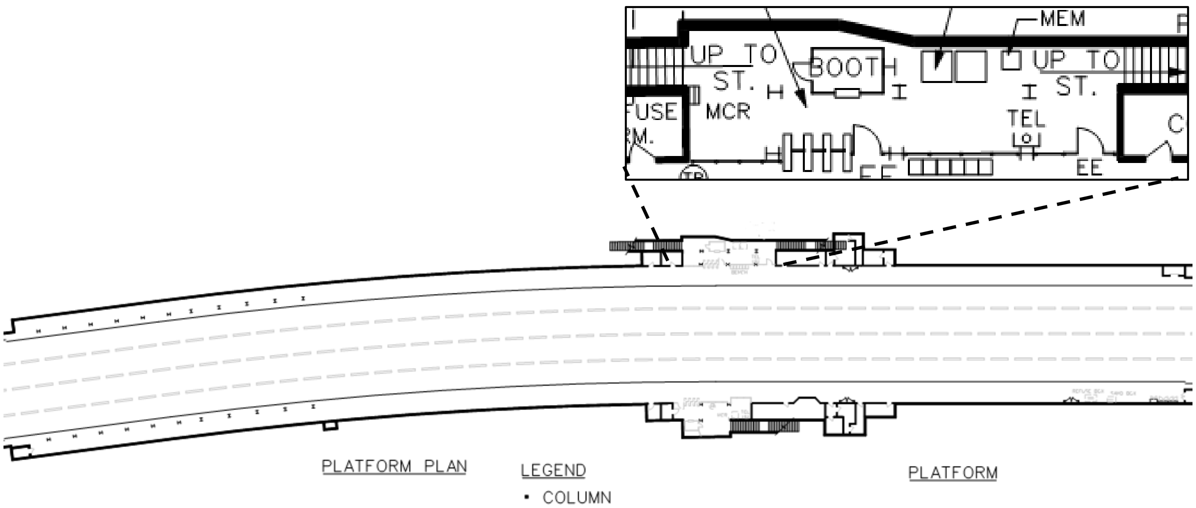

***Figure 1 –** Congested/Narrow Station Plan*
Prospect Avenue Station

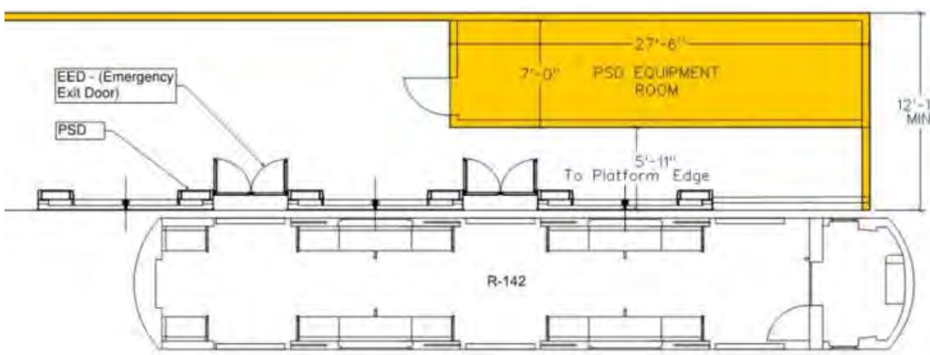

***Figure 2 –** Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimensions)

1.06 – MR 031 | 25th Street Station

Summary: *25th Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

25th Street Station is a below grade station with two side platforms. The platform structure is cast-in-place concrete. The width of the platforms is approximately 8'-4" throughout. Columns occupy only the northern third of the platforms with column faces 2'-4" away from the platform edge. Due to the extremely limited width of the existing platforms, there is no available space for an equipment room. Figure 2, below, shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the northbound control area. The southbound control area is similar.

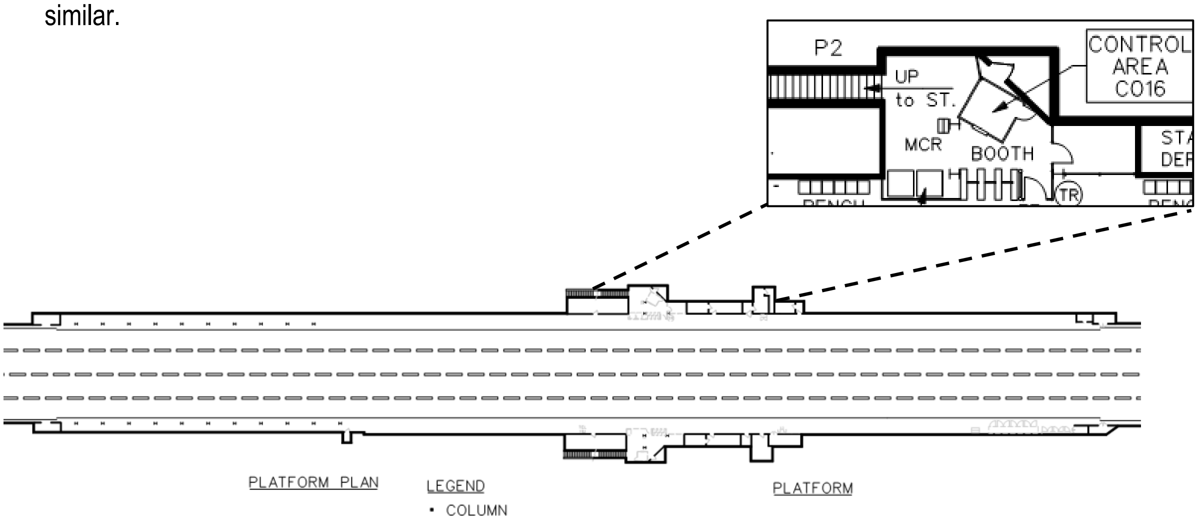

Figure 1 – *Congested/Narrow Station Plan*
25th Street Station

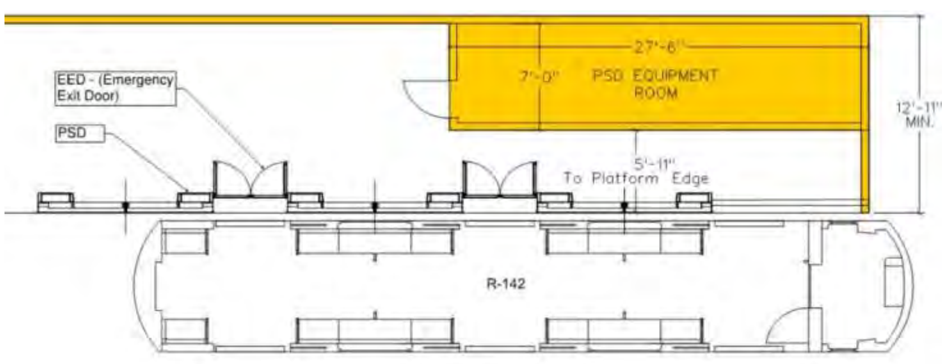

Figure 2 – *Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimensions)

on

1.07 – MR 032 | 36th Street Station

Summary: *36th Street Station is not feasible for both APGs and PSDs due to the row of columns at 12" from the platform edge. (see figure 1).The barrier itself is15" thick and requires free space for maintenance purposes.*

Description

The 36th Street Station is a below-grade station with two center / island platforms. The platform structure is cast-in-place concrete. The width of the platforms varies from 13'-0" to 19'-2". Columns are spaced 15'-6" on center with column faces 1'-0" away from platform edges on the express side. The inside face of the barrier itself is 15" minimum from the concrete platform edge, and requires free space for maintenance and operation. **(see Figure 1)**.

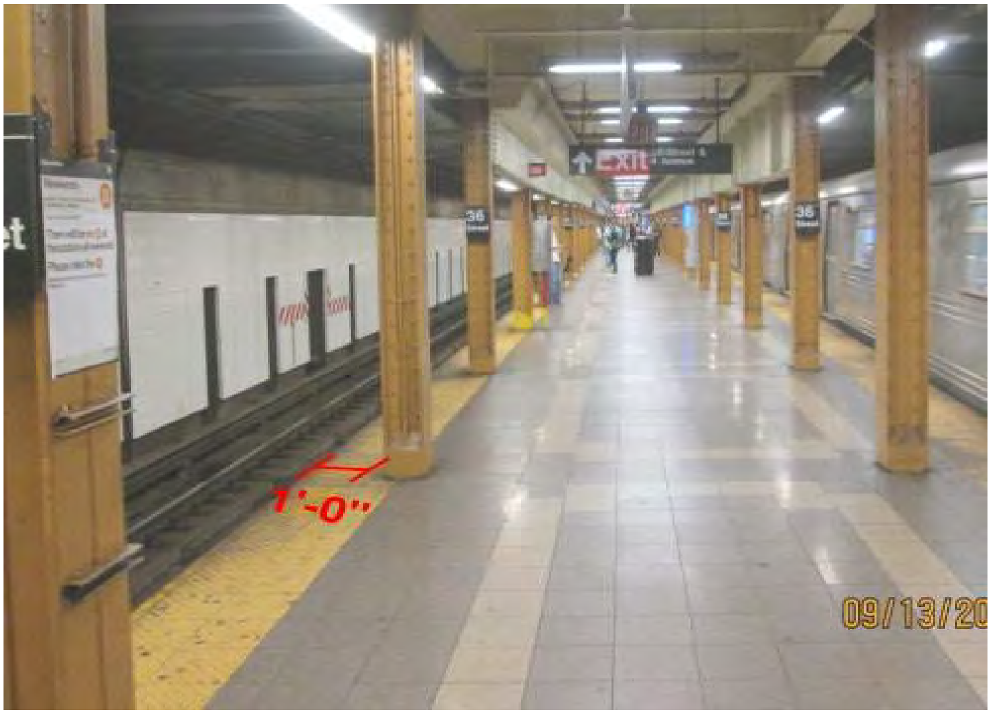

Figure 1 – *Obstruction within 12"*
36th Street Station

1.08 – MR 058 | Coney Island Stillwell Avenue Station

Summary: *Coney Island Stillwell Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the southbound platform as the existing width is 4'-6" (see figure 1).*

Description

Coney Island Stillwell Avenue Station is an elevated station with four straight island platforms. Each platform is dedicated to one of the following services, 'N', 'Q', 'F' and 'D' which is the subject of this report. The other services are addressed in previously issued reports. The platform structures are cast-in-place concrete. The width of the 'D' platform ranges from 19'-0' to 20'-6". The corridor width adjacent to the permanent structure at the south end of the platform shown in photo below, is 4'-6" in width. Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

***Figure 1** – Non-Compliant egress condition*
Coney Island Stillwell Avenue Station

1.09 – MR 059 | 9th Avenue Station

Summary: *9th Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

The 9th Avenue Station is an at grade station with two straight center / island platforms. The platform structures are cast-in-place concrete. The platform widths are approximately 11'-0" throughout. The platforms are straight with two rows of columns measuring approximately 3'-4" from the platform edges. At the platform staircases, the columns measure 3'-4" from the platform edge and 0'-8" from the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 40" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains

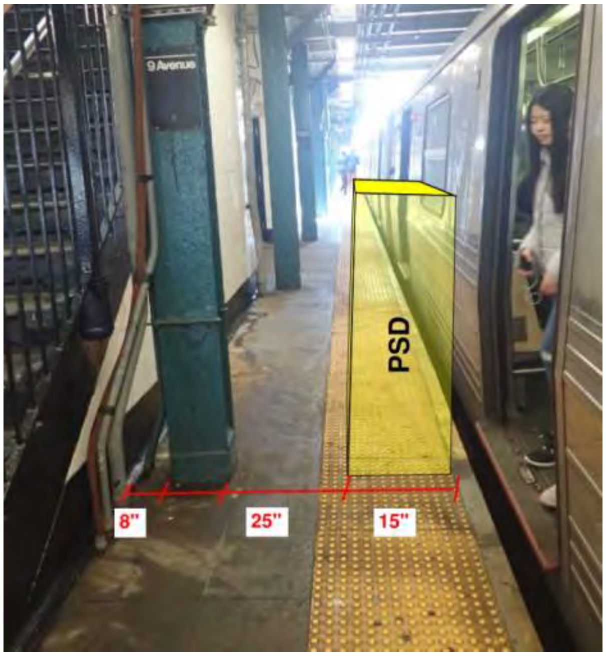

Figure 1 *– Non-compliant ADA dimension*
9th Avenue Station

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1.10– MR 060 | Fort Hamilton Parkway Station

Summary: *Fort Hamilton Parkway is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 2).*

Description

The Fort Hamilton Parkway Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 11'-4" to 11'-6". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Fort Hamilton Station

Figure 2 *– Precast Slab*
Fort Hamilton Station

1.11 – MR 061 | 50th Street Station

Summary: *50th Street is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 2).*

Description

The 50th Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 11'-4" to 11'-6". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

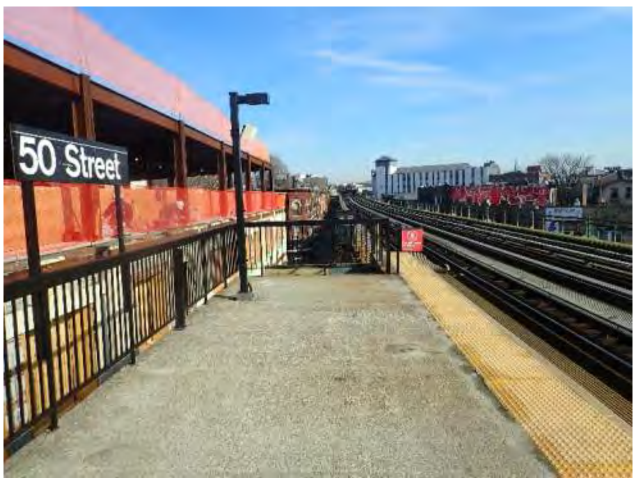


Figure 1 *– General Station Condition*
50th Street Station

Figure 2 *– Precast Slab*
50th Street Station

1.12 – MR 062 | 55th Street Station

Summary: *55th Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 2).*

Description

The 55th Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 11'-4" to 11'-10". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference

Figure 1 *– General Station Condition*
55th Street Station

Figure 2 *– Precast Slab*
55th Street Station

1.13 – MR 063 | 62nd Street Station

Summary: *62nd Street Station not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 2).*

Description

The 62nd Street Station is an elevated station with two center/island platforms. The platform structures are precast concrete. The width of the platforms is approximately 15'-2" throughout. The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
62nd Street Station

Figure 2 *– Precast Slab*
62nd Street Station

1.14– MR 064 | 71st Street Station

Summary: *71st Street is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 2).*

Description

The 71st Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms is approximately 11'-4" throughout. The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
71st Street Station

Figure 2 *– Precast Slab*
71st Street Station

1.15 – MR 065 | 79th Street Station

Summary:*79th Street Station not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 2).*

Description

The 79th Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 11'-4" to 11'-10". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
79th Street Station

Figure 2 *– Precast Slab*
79th Street Station

1.16 – MR 066 | 18th Avenue Station

Summary: *18th Avenue Street not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 2).*

Description

The 18th Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 10'-0" to 11'-8". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
18th Avenue Station

Figure 2 *– Precast Slab*
18th Avenue Station

1.17 – MR 067 | 20th Avenue Station

Summary: *20th Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 2).*

Description

The 20th Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 6'-4" to 11'-6". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
20th Avenue Station

Figure 2 *– Precast Slab*
20th Avenue Station

1.18 – MR 068 | Bay Parkway Station

Summary: *Bay Parkway Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 2).*

Description

The Bay Parkway Station is an elevated station with two center/island platforms. The platform structures are precast concrete. The width of the platforms is approximately 15'-4" throughout. The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Bay Parkway Station

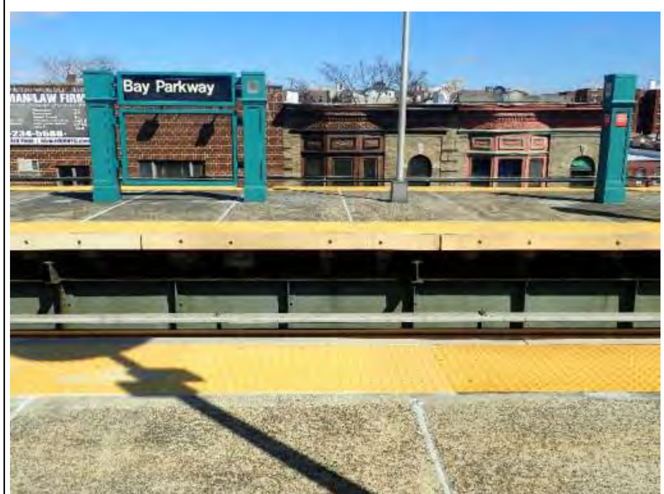


Figure 2 *– Precast Slab*
Bay Parkway Station

1.19 – MR 069 | 25th Avenue Station

Summary: *25th Avenue station not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 2).*

Description

The 25th Avenue Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 6'-2" to 11'-4". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
25th Avenue Station

Figure 2 *– Precast Slab*
25th Avenue Station

1.20 – MR 070 | Bay 50th Street Station

Summary: *Bay 50th Street Station not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 2).*

Description

The Bay 50th Street Station is an elevated station with two side platforms. The platform structures are precast concrete. The width of the platforms varies from approximately 6'-0" to 11'-2". The platforms are straight with one row of columns supporting their respective station canopies See figure 1 & 2 for reference.

***Figure 1** – General Station Condition*
Bay 50th Street Station

***Figure 2** – Precast Slab*
Bay 50th Street Station

1.21 – MR 151 | 145th Street St. Nicholas Avenue Station

Summary: *145th Street St. Nicholas Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 33" (see figure 1).*

Description

The 145th Street St. Nicholas Avenue Station is a below grade station with two straight center / island platforms at each level of this two-level station. The B-train service utilizes the lower level. The platform structures are cast-in-place concrete. The width of the platforms at the platform staircases is 4'-0". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 33" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA dimension*
145th Street Station

1.22 – MR 153 | 125th Street St. Nicholas Avenue Station.

Summary: *125th Street St. Nicholas Ave. Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

125th Street St. Nicholas Ave. Station is a below-grade station with two center / island platforms (**see Figure 1)**. The platform structures are cast-in-place concrete. Columns are distributed evenly along the center of each platform and measure 8'-4" from the platform edge. The platform widths vary from approximately 17'-4" to 17'-10". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting

Equipment Room

Since there are 4 platform edges at this station, 2 full size equipment rooms would be required. Both equipment rooms could be located at the center of the station mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

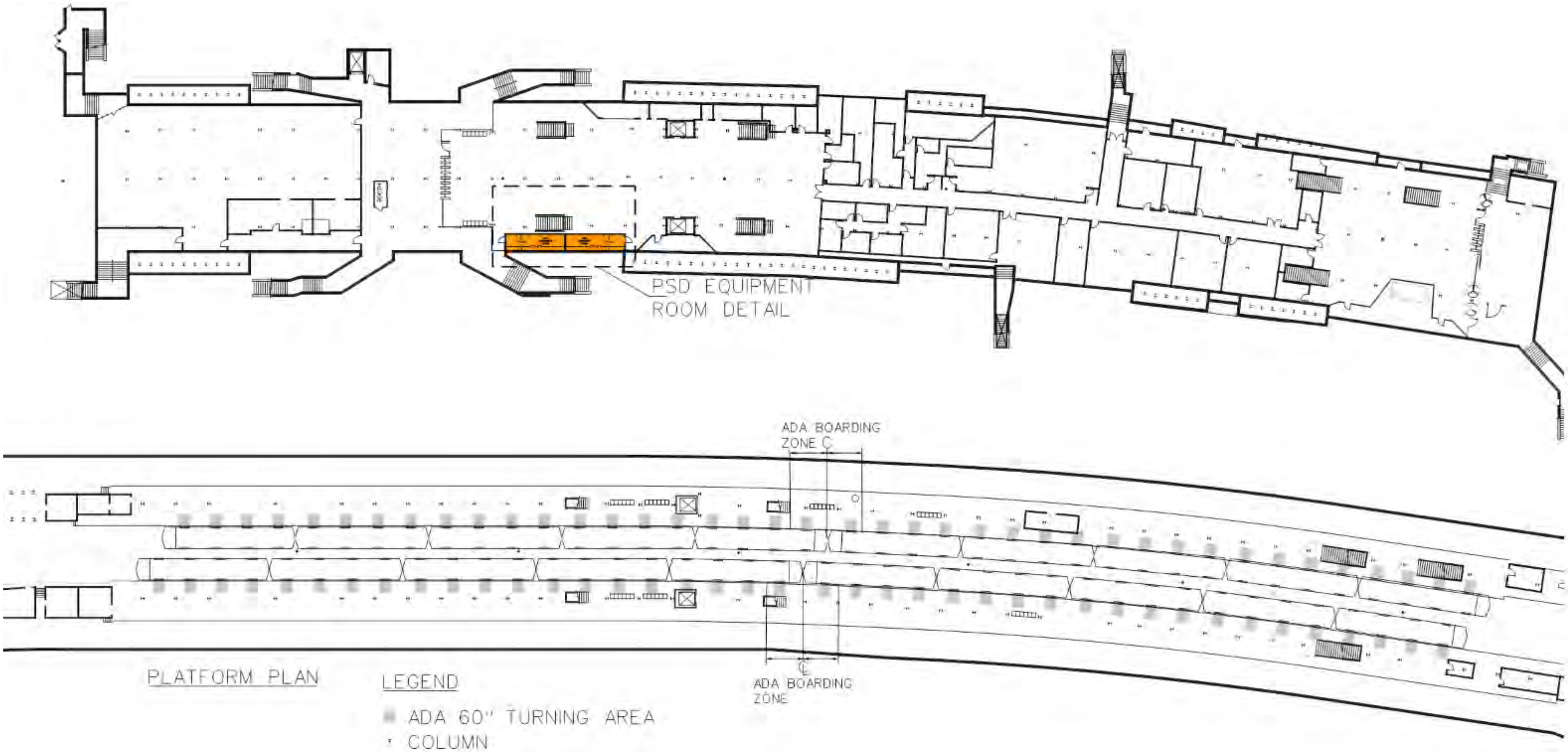


Figure 1 – Overall Station Plan
125th Street Station

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'D' Line Stations
(125th Street Station)

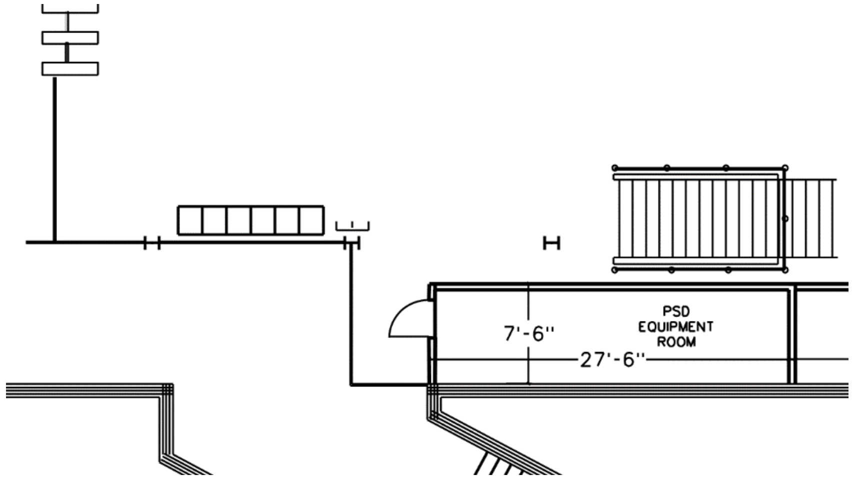


Figure 2 *– PSD Equipment Room Detail*
125th Street Station

Figure 3 *– Typical platform view*
125th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal Service)

Station Name	125th Street St. Nicholas Ave.
Peak Demand Load from ConEd Report, (kW)	245.6 (combined)
Apparent Power (kVA)	307.0
Station Peak Demand Load, Max Current, (A)	852.8
Maximum Amount of Doors	160
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	1193
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	7
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 1200A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis (Normal Service)

Station
Power Capacity Analysis (Reserve Service)

Station Name	125th Street St. Nicholas Ave.
Peak Demand Load from ConEd Report, (kW)	245.6 (combined)
Apparent Power (kVA)	307.0
Station Peak Demand Load, Max Current, (A)	852.8
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	1193
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	7
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 1200A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve

Table 2. Power Capacity Analysis (Reserve Service)

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.4M to install APGs and $41.5M to install PSDs (See Appendix E)

1.23 – MR 161 | 59th Street Columbus Circle Station

Summary: *59th Street Columbus Circle Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 21" (see figure 1).*

Description

59th Street Columbus Circle Station is a below-grade station consisting of two center / island platforms (there is a third island platform which is closed to the public). The platform widths vary from approximately 10'-8" – 29'-0". The platforms are mildly curved with two rows of columns approximately 3'-4" from edge of platform. At the platform staircases, the columns measure 3'-0" from the platform edge and 2'-2" from the staircase .The implementation of a platform edge barrier would reduce the currently compliant width of 36" to 21" or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

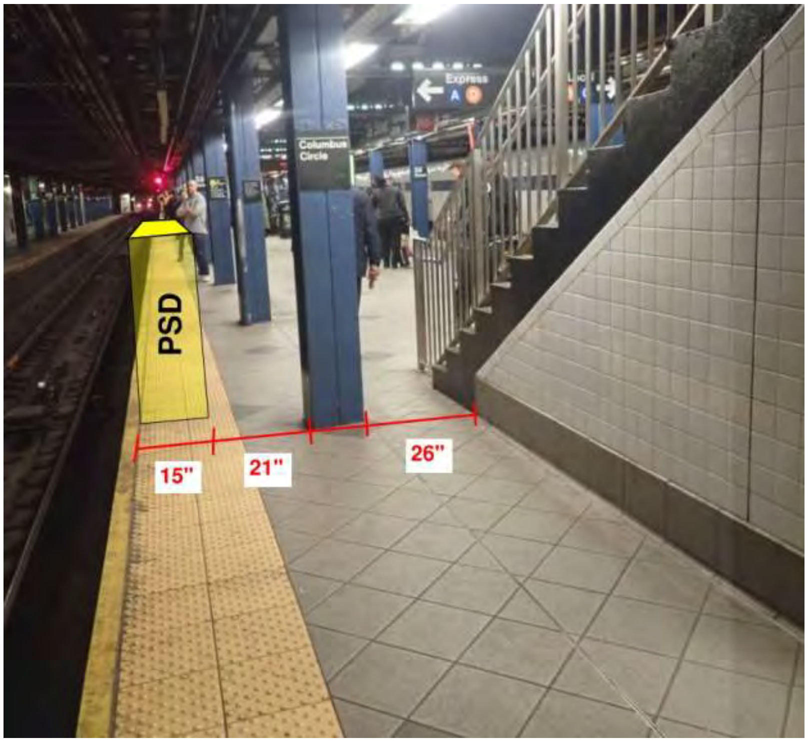


***Figure 1** –platform*
59th Street Columbus Circle Station

1.24 – MR 210 | 205th Street Norwood Station

***Summary:** 205th Street Norwood Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

205th Street Norwood Station is a below-grade station with two straight center / island platforms. The platform structures are cast-in-place concrete. The platform widths are approximately 17'-6" throughout. The platforms are straight with two rows of columns measuring approximately 3'-4" from the platform edges. At the platform staircases, the columns measure 3'-4" from the platform edge and 0'-8" from the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 40" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
205th Street Norwood

1.25 – MR 211 | Bedford Park Blvd Station

Summary: *Bedford Park Blvd Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

Bedford Park Blvd. Station is a below-grade station consisting of two center / island platforms. The platform widths are approximately 19'-0" throughout. The platforms are straight with two rows of columns approximately 3'-4" from edge of platform. At the platform staircases, the columns measure 3'-4" from the platform edge and 26" from the staircase.The implementation of a platform edge barrier would reduce the currently compliant width of 40" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** –platform*
Bedford Park Blvd Station

1.26 – MR 212 | Kingsbridge Road Station

***Summary:** Kingsbridge Road Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

Kingsbridge Road Station is a below-grade station consisting of two center / island platforms. The platform widths are approximately 19'-6" throughout. The platforms are straight with two rows of columns approximately 3'-4" from edge of platform. At the platform staircases, the columns measure 3'-4" from the platform edge and 1'-8" from the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 40" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** –platform*
Kingsbridge Road Station

1.27 – MR 213 | Fordham Road Station

Summary: : *Fordham Road Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 25" (see figure 1).*

Description

Fordham Road Station is a below-grade station consisting of two center / island platforms. The platform widths vary from approximately 10'-8" to 54'-8". The platforms are straight with two rows of columns approximately 3'-4" from edge of platform. At the platform staircases, the columns measure 3'-4" from the platform edge and 1'-10" from the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 40" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *–platform*
Fordham Road Station

1.28 – MR 214 | 182nd St 183rd St Station

Summary: *182nd-183rd St Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1).*

Description

182nd-183rd St Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The platform widths are approximately 11'-8" throughout. The platforms are straight with one row of columns approximately 3'-4" from edge of platform. At the platform staircases, the columns measure 3'-4" from the platform edge and 2'-0" from the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 40" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

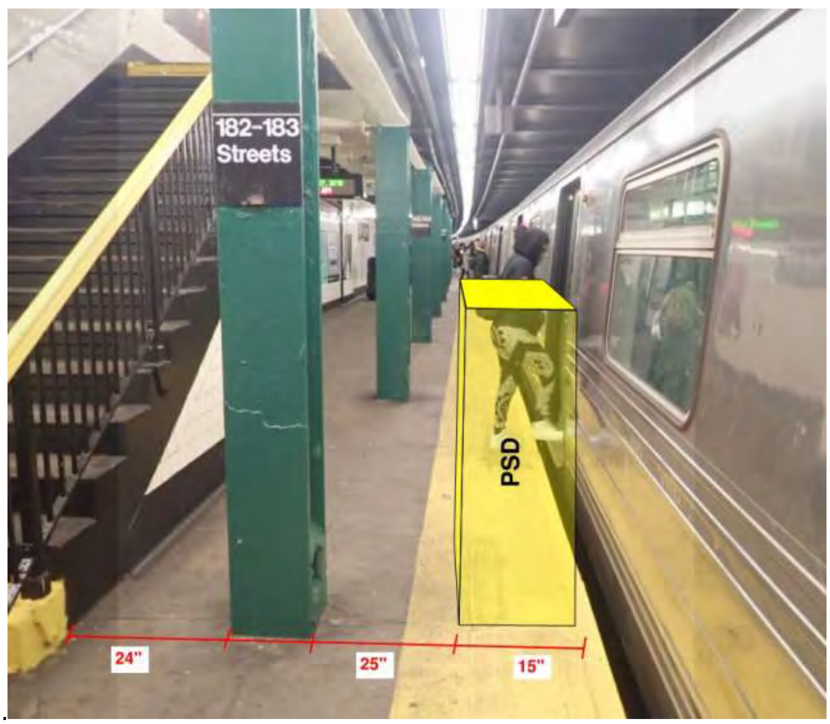


Figure 1 *– Non-Compliant ADA condition*
182nd-183rd Sts Station

1.29 – MR 215 | Tremont Avenue Station

Summary: *Tremont Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1).*

Description

Tremont Avenue Station is a below-grade station consisting of two center / island platforms. The platform widths are approximately 22'-0" throughout. The platforms are straight with two rows of columns approximately 3'-4" from edge of platform. At the platform staircases, the columns measure 3'-4" from the platform edge and 1'-4" from the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 40" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
Tremont Avenue

1.30 –MR 216 | 174th St 175 St Station

Summary: *174th-175th St Station is feasible for both APGs and PSDs. There are two ceiling mounted monitors located at the center of the southbound platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The 174th-175th St Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are columns evenly distributed along the platform edge measuring 3'-6" from the platform edge. The platform widths vary from approximately 10'-8" to 21'-0". On the southbound platform there are two ceiling mounted signals located above the platform edge, with a vertical clearance of at least 6'-8". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting

Equipment Room

The equipment room can be located at the edge of the station mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

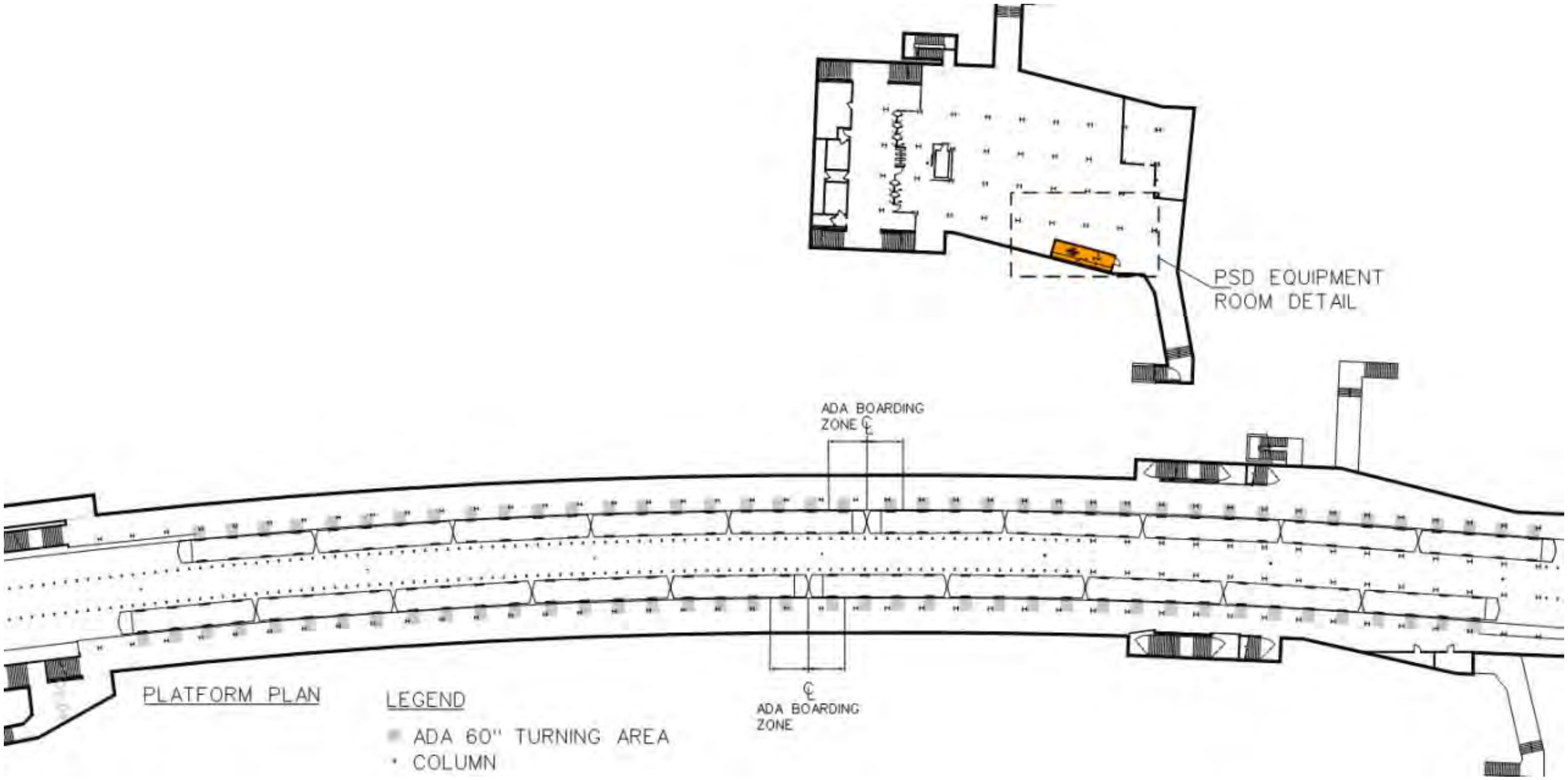


***Figure 1** – Overall plan*
174th - 175th Street Station

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'D' Line Stations
(174th - 175th Street Station)

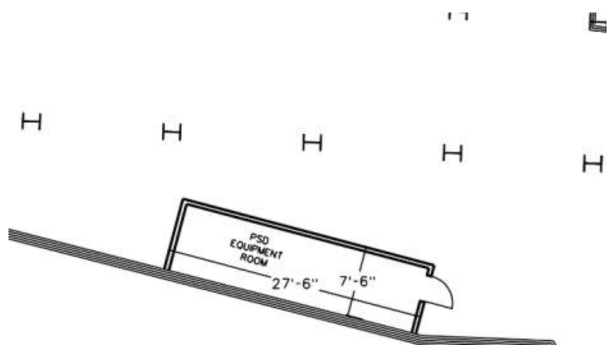


Figure 2 *– PSD Equipment Room Detail*
174th - 175th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear LED fixtures mounted parallel to the platform edge but inboard of the columns. No alterations to the existing lighting configuration are anticipated.

Power:

This station has adequate capacity to support the implementation of a APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal Service)

Station Name	174th 175th St.
Peak Demand Load from ConEd Report, (kW)	70.8 (combined)
Apparent Power (kVA)	88.5
Station Peak Demand Load, Max Current, (A)	245.8
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	440
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	360
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve.

Table 1. Power Capacity Analysis (Normal Service)

Station
Power Capacity Analysis (Reserve Service)

Station Name	174th 175th St.
Peak Demand Load from ConEd Report, (kW)	70.8 (combined)
Apparent Power (kVA)	88.5
Station Peak Demand Load, Max Current, (A)	245.8
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	440
Station Service Power Capacity, (A)	800
Service Spare Capacity, (A)	360
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combine for both Normal & Reserve

Table 2. Power Capacity Analysis (Reserve Service)

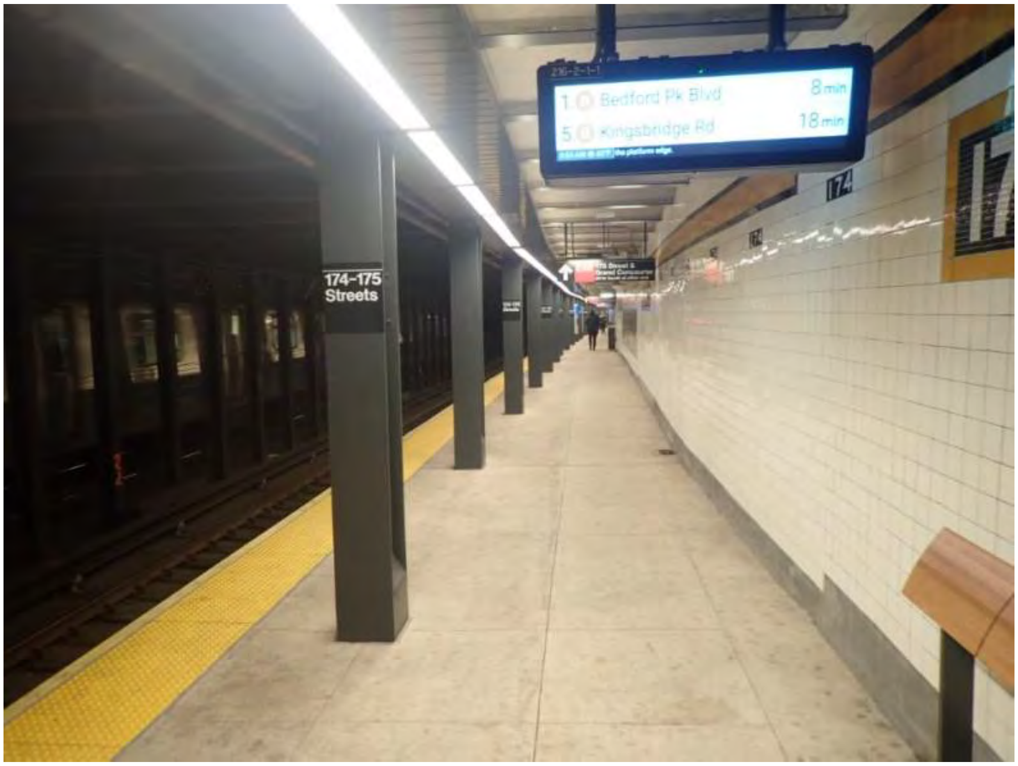


***Figure 3** – General platform view*
174th -175th St Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.2M to install APGs and $40.6M to install PSDs (See Appendix E)

1.31 –MR 217 | 170th Street Station

Summary: *170th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1).*

Description

170th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The platform widths are approximately 11'-4" throughout. The platforms are straight with one row of columns approximately 3'-4" from edge of platform. At the platform staircases, the columns measure 3'-4" from the platform edge and 1'-8" from the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 40" to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – Non-Compliant ADA condition
170th Street

1.32 –MR 218 | 167th Street Station

Summary: *167th Street Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The 167th Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. The platform widths vary from approximately 11'-4" to 13'-8". There are columns evenly distributed along the platform edge measuring 3'-4" from the platform edge. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting

Equipment Room

The equipment room can be located at the center of the station mezzanine (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

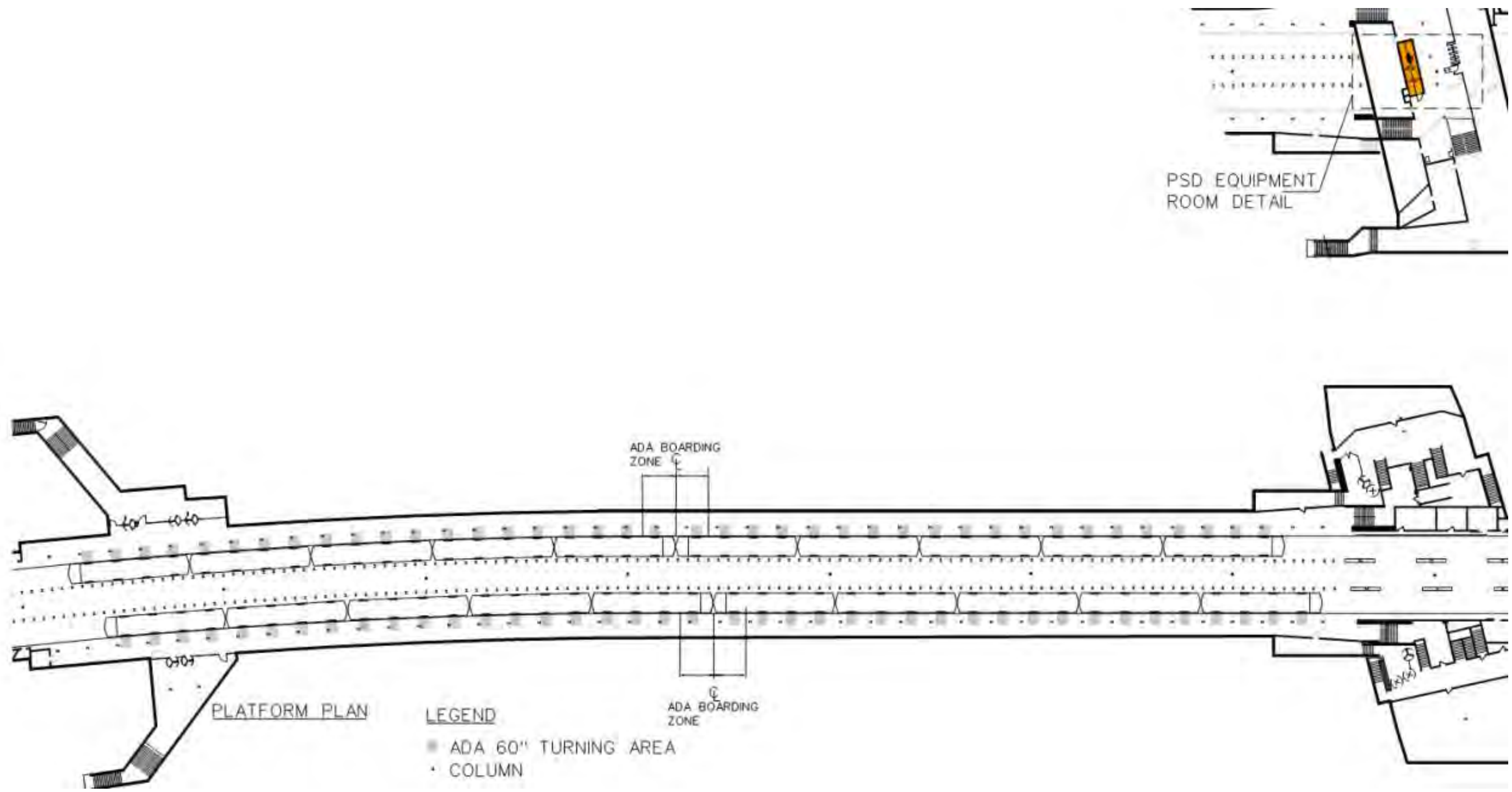


Figure 1 *– Overall plan*
167th Street Station

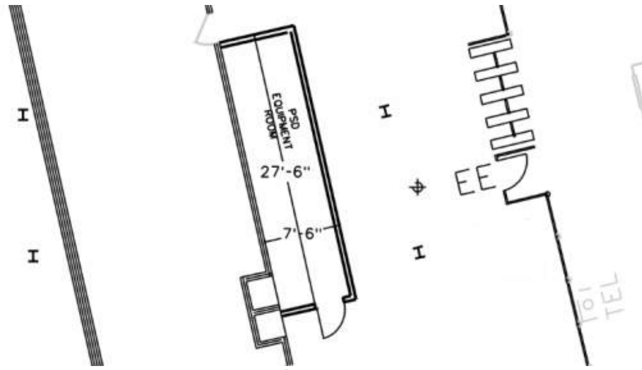


Figure 2 *– PSD Equipment Room Detail*
167th Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear LED fixtures mounted parallel to the platform edge but inboard of the columns. No alterations to the existing lighting configuration are anticipated.

Power:

This station has adequate capacity to support the implementation of a APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal Service)

Station Name	167th Street
Peak Demand Load from ConEd Report, (kW)	87.8 (combined)
Apparent Power (kVA)	109.8
Station Peak Demand Load, Max Current, (A)	304.9
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	499.5
Station Service Power Capacity,(A)	800
Service Spare Capacity, (A)	301
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combined for both Normal & Reserve.

Table 1. Power Capacity Analysis (Normal Service)

Station
Power Capacity Analysis (Reserve Service)

Station Name	167th Street
Peak Demand Load from ConEd Report, (kW)	87.8 (combined)
Apparent Power (kVA)	109.8
Station Peak Demand Load, Max Current, (A)	304.9
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	499.5
Station Service Power Capacity,(A)	800
Service Spare Capacity, (A)	301
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 800A Service. Station has (2) separate meters for each Normal & Reserve service. However, demand readings are combined for both Normal & Reserve

Table 2. Power Capacity Analysis (Reserve Service)

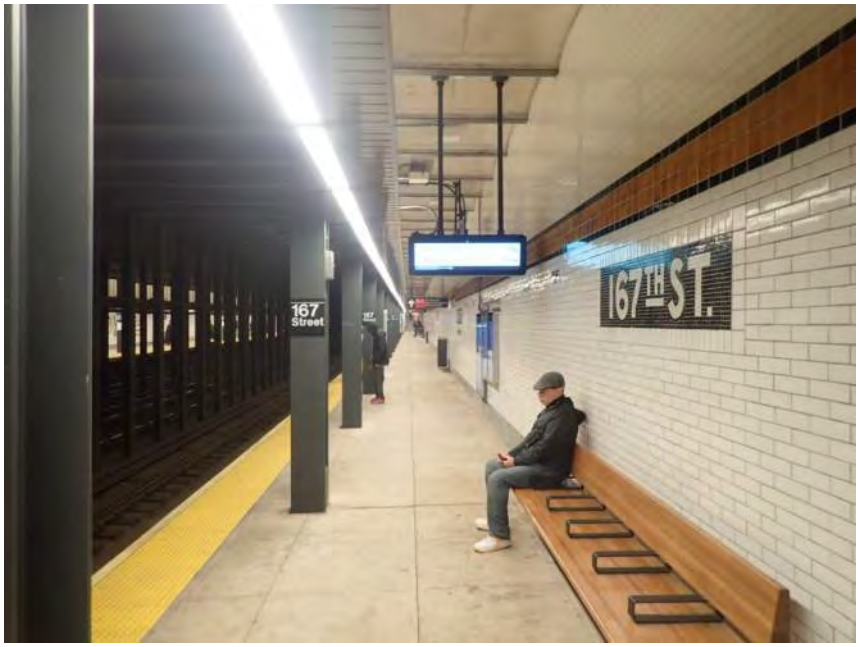


***Figure 3** – General platform view*
167th Street Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.9M to install APGs and $40.1M to install PSDs (See Appendix E)

1.33 –MR 219 | 161st Street Yankee Stadium Station

Summary: *161st Street Yankee Stadium Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met on the northbound platform as the remaining width would be 27" (see figure 1).*

Description

161st Street Yankee Stadium Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The platform widths are approximately 15'-4" throughout. The platforms are straight with one row of columns approximately 3'-6" from edge of platform. At the northern end of the northbound platform, the columns measure 3'-6" from the platform edge and 1'-8" from a vent wall. The implementation of a platform edge barrier would reduce the currently compliant width of 42" to 27" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – Non-Compliant ADA condition
161st Street Yankee Stadium Street

1.34 –MR 220 | 155th Street Station

Summary: *155th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 23" (see figure 1).*

Description

The 155th Street Station is a below grade station with two straight side platforms. The platform structures are cast-in-place concrete. The platform widths are approximately 15'-4" throughout. The platforms are straight with one row of columns approximately 3'-2" from edge of platform. At the platform staircases, the columns measure 3'-2" from the platform edge and 1'-4" from the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 38" to 23" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

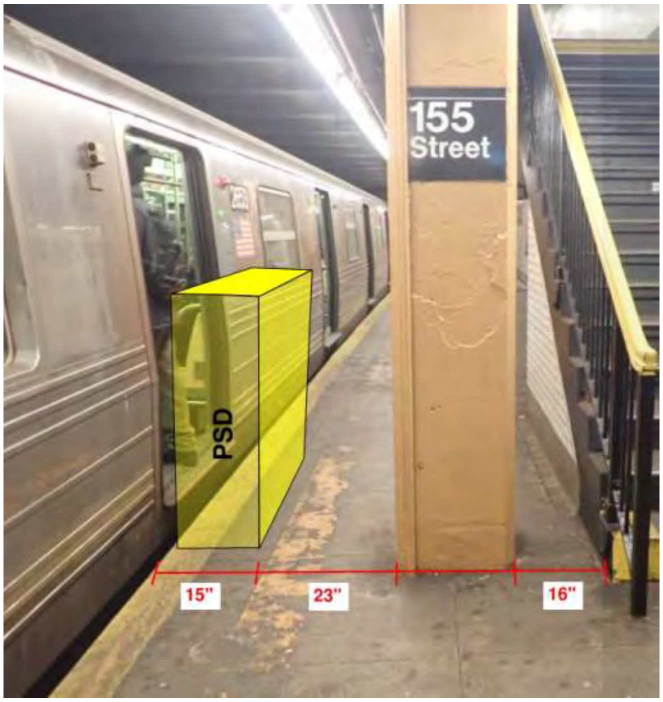


***Figure 1 –** Area of ADA non-compliance*
155th Street Station

1.35 –MR 231 | Grand Street Station

Summary: *Grand Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 27" (see figure 1).*

Description

The Grand Street Station is a below grade station with two straight side platforms. The platform structures are cast-in-place concrete. The platform widths are approximately 8'-8" throughout. The platforms are straight with one row of columns approximately 3'-6" from edge of platform. At the platform staircases, the columns measure 3'-6" from the platform edge and 1'-8" from the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 42" to 27" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

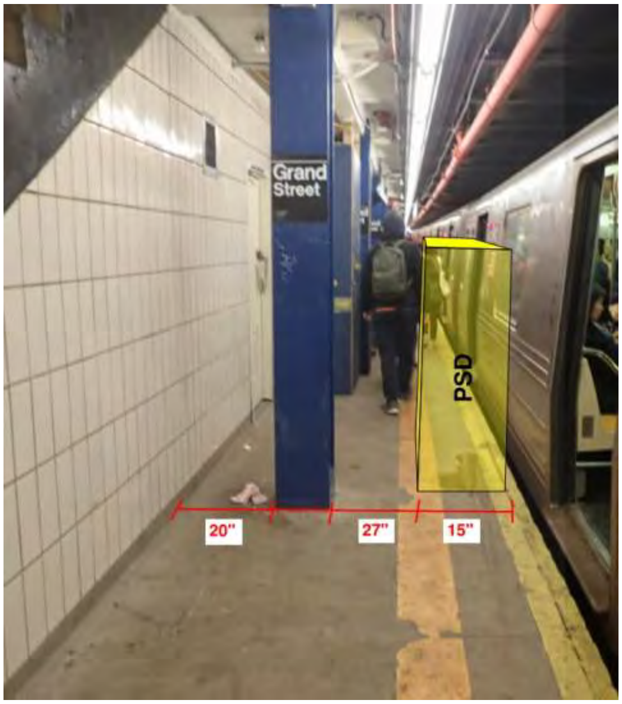


Figure 1 – *Area of ADA non-compliance*

1.36 –MR 277 | 7th Avenue Station (Manhattan)

Summary: *7th Avenue Station is feasible for both APGs and PSDs. There are four ceiling mounted signals located at the lower platform edges which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG system (see structural report; Appendix B). Existing power is adequate.*

Description

7th Avenue Station is a below-grade station with two levels of center / island platforms **(see Figure 1)**. The B train utilizes the south side of both the upper and lower platform. The platform structures are cast-in-place concrete. At the upper level platform, column faces are typically 5'-4" from the platform edge and the platform measures 29'-4" wide throughout. At the lower level platform column faces typically measure 2'-8" from the Queens-bound platform edge and 3'10" from the Uptown-bound platform edge. The platform width varies from 13'-0" to 24'-8". On the lower platform there are four ceiling mounted signals located above the platform edge, measuring no less than 7'-4" above the ground. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Ceiling mounted signals located above the platform edge would need to be relocated in the implementation of full height PSDs.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

Since there are 4 platform edges at this station, 2 full size equipment rooms would be required. The equipment rooms could be located at the western end of the upper level platform adjacent to staircase P9 and at the center of the lower platform (**see Figure 1, Figure 2 & Figure 3).** The proposed room dimension are 27'-0" x 6'-6" each.

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed in the 1990s. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would at a minimum be required for the installation of an APG system.

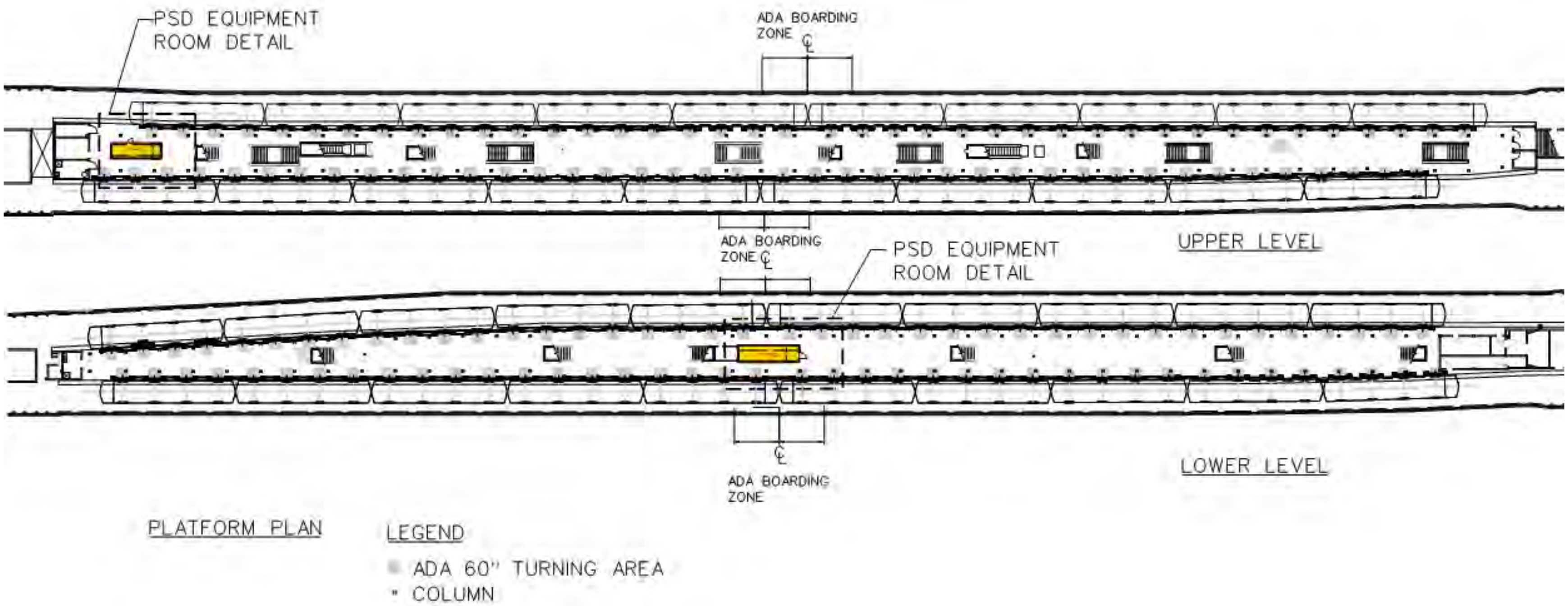


***Figure 1** – Overall Station Plan*
7th Avenue Station

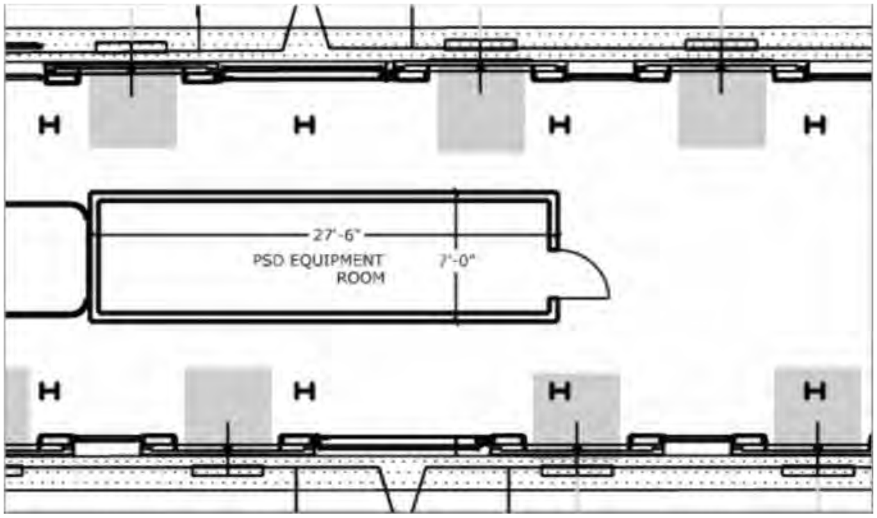


Figure 2 – PSD Equipment Room 1 Detail
7th Avenue Station

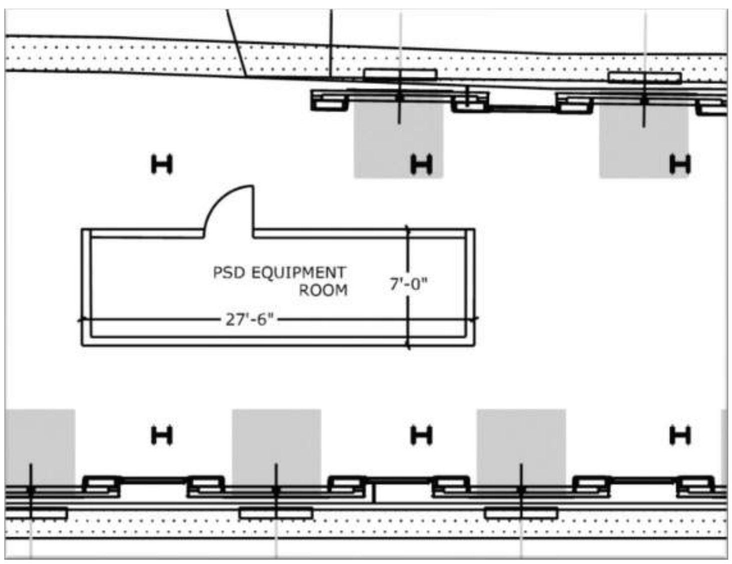


Figure 3 – PSD Equipment Room 2 Detail
7th Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 and 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal service)

Station Name	7th Avenue
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	76.8
Apparent Power (kVA)	96.0
Station Peak Demand Load, Max Current, (A)	266.7
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.8
Total Load (Station Peak + PSD), (A)	607
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	193
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram. Station has (2) separate meter reading, for each Normal & Reserve service.

Table 1*- Power Capacity Analysis - Normal*

Station Power Capacity Analysis (Reserve service)

Station Name	7th Avenue
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	78.0
Apparent Power (kVA)	97.5
Station Peak Demand Load, Max Current, (A)	270.8
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.8
Total Load (Station Peak + PSD), (A)	612
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	188
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram. Station has (2) separate meter reading, for each Normal & Reserve service.

Table 2*- Power Capacity Analysis - Reserve*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.5M to install APGs and $42.4M to install PSDs (See Appendix E)

Figure 4 *– Typical platform view*
7th Avenue Station

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

1.0 *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*

1.1 *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*

1.2 *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*

- *a. Column location in relation to the platform edge*
- *b. Platform edge clearance adjacent to stairs and other impediments*
- *c. Impacts to ADA path of travel and boarding areas*
- *d. Conflicts of PSD/APG/RPSDs with Signals cables*
- *e. Sufficient platform width*
- *f. Extreme non-tangent track*

1.3 *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*

- *a. Structural capacity of platforms to accept PSD/APG/RPSDs*
- *b. Feasibility & location for PSD/APG/RPSDs equipment room*
- *c. Confirmation of adequate power for PSD/APG/RPSDs*
- *d. Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
- *e. Determination of communications requirements, availability and cost*
- *f. Determination of gap detection and entrapment avoidance technology requirements*
- *g. Determination of light fixture or other conflicts due to existing conditions*

1.4 *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*

1.5 *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
    - Double the amount of motors as PSDs (each motor operating a single leaf).
    - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
    - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
    - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY. Status of doors will be provided to crew via indicator lights, with no automated propulsion cutout.

If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

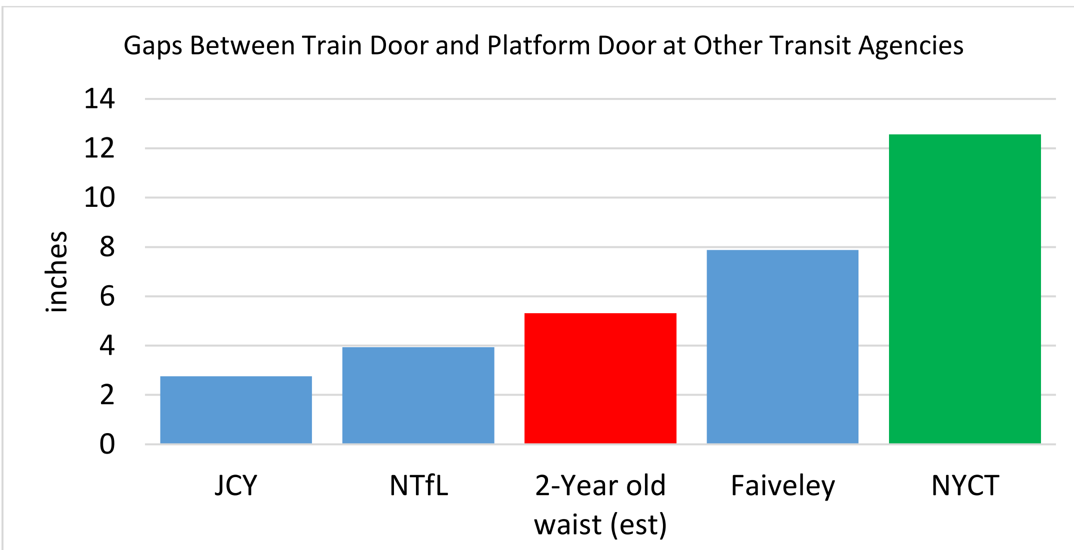


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

 *Figure 3 - Paris: no entrapment detection*	 *Figure 4 - Paris: no entrapment detection*	 *Figure 5 - France ATO: no entrapment detection*
 *Figure 6 - Paris, on curve: used 3 2D scanning lasers per door*	 *Figure 7 - Shanghai: End of platform light detection*	 *Figure 8 - Seoul: Platform observers*

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

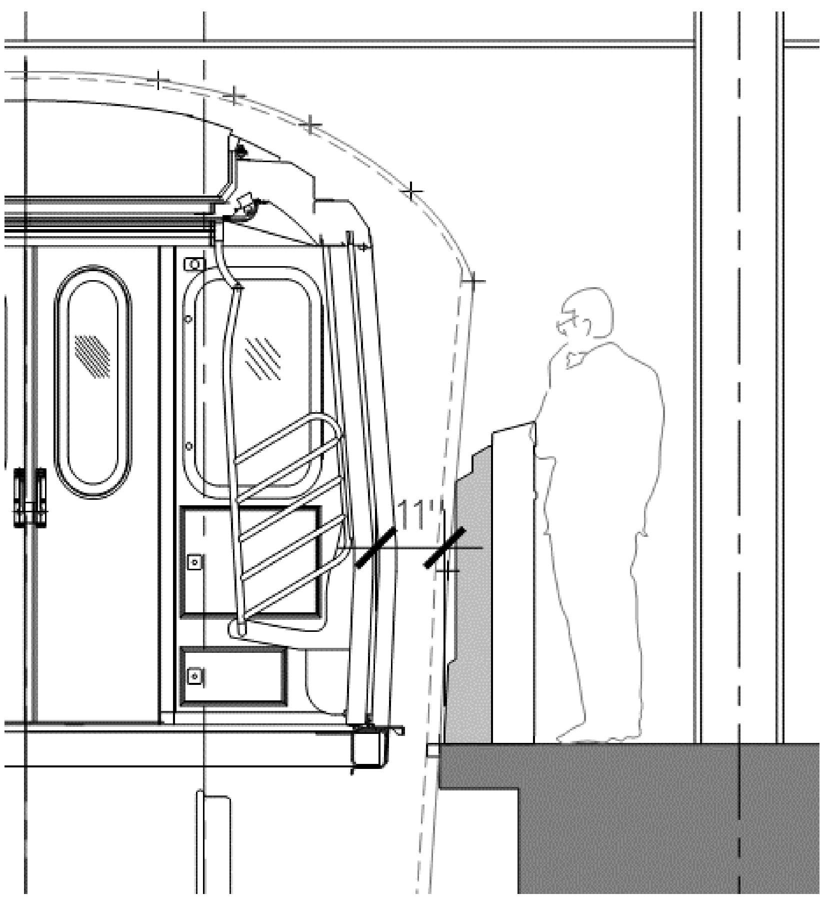


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber “bumpers” on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6” into the line equipment envelope. This would leave a 5” gap between the platform and car doors allowing approximately 2” of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5" by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor's window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor's window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **bold/underline**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	**PSD System 1**	**PSD System 2**	**PSD System 3**
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are "existing" as defined by code. All the rolling stock is also to be considered "existing" under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60" radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36" of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

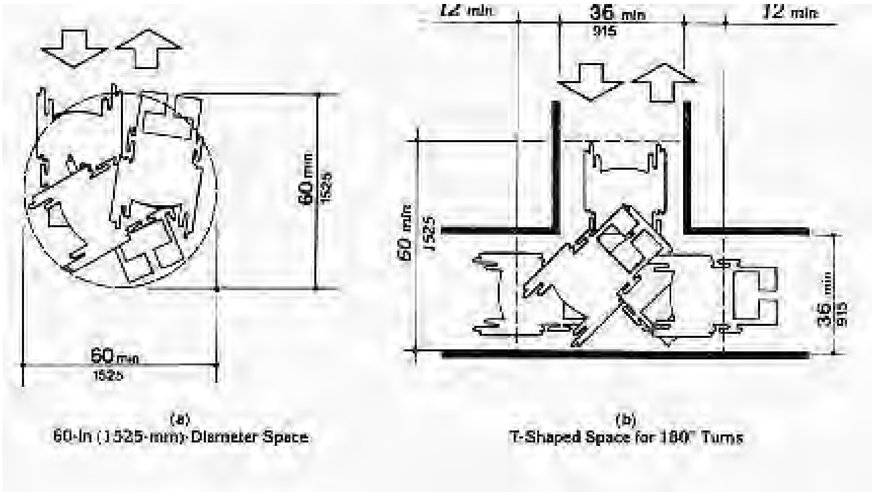
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

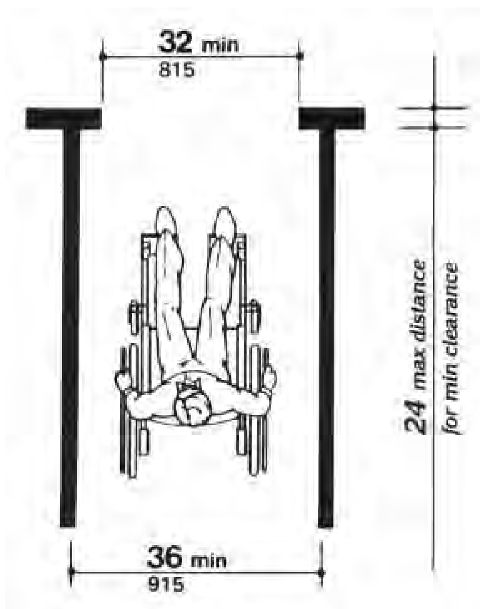


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as “existing”; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60” turning radius in which to make this turn. (the “T” shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an “alteration to the path of travel”, requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32” point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

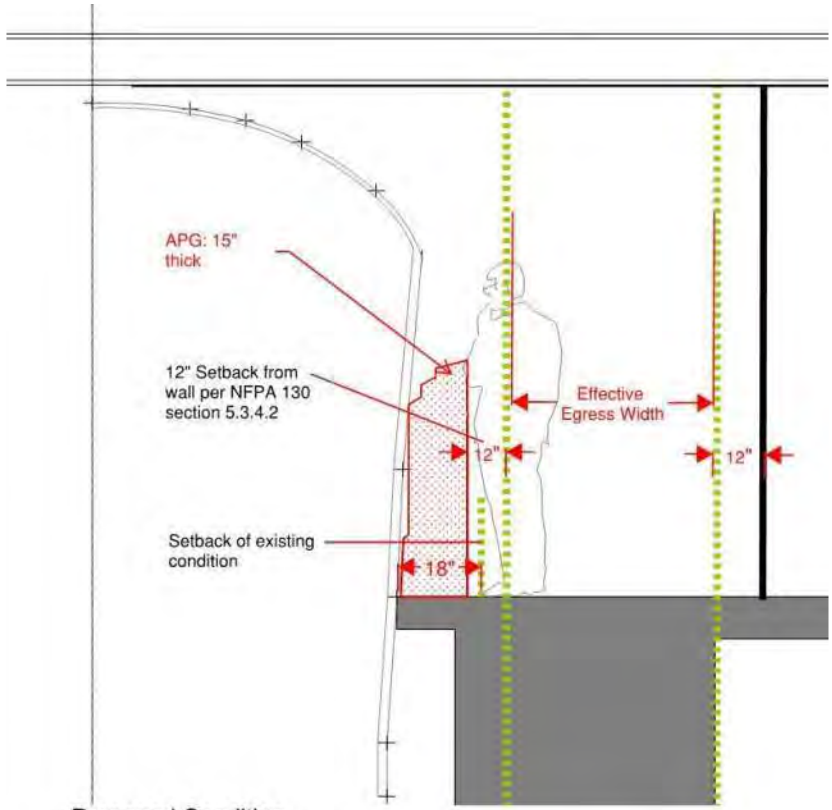
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15" of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

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Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

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Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

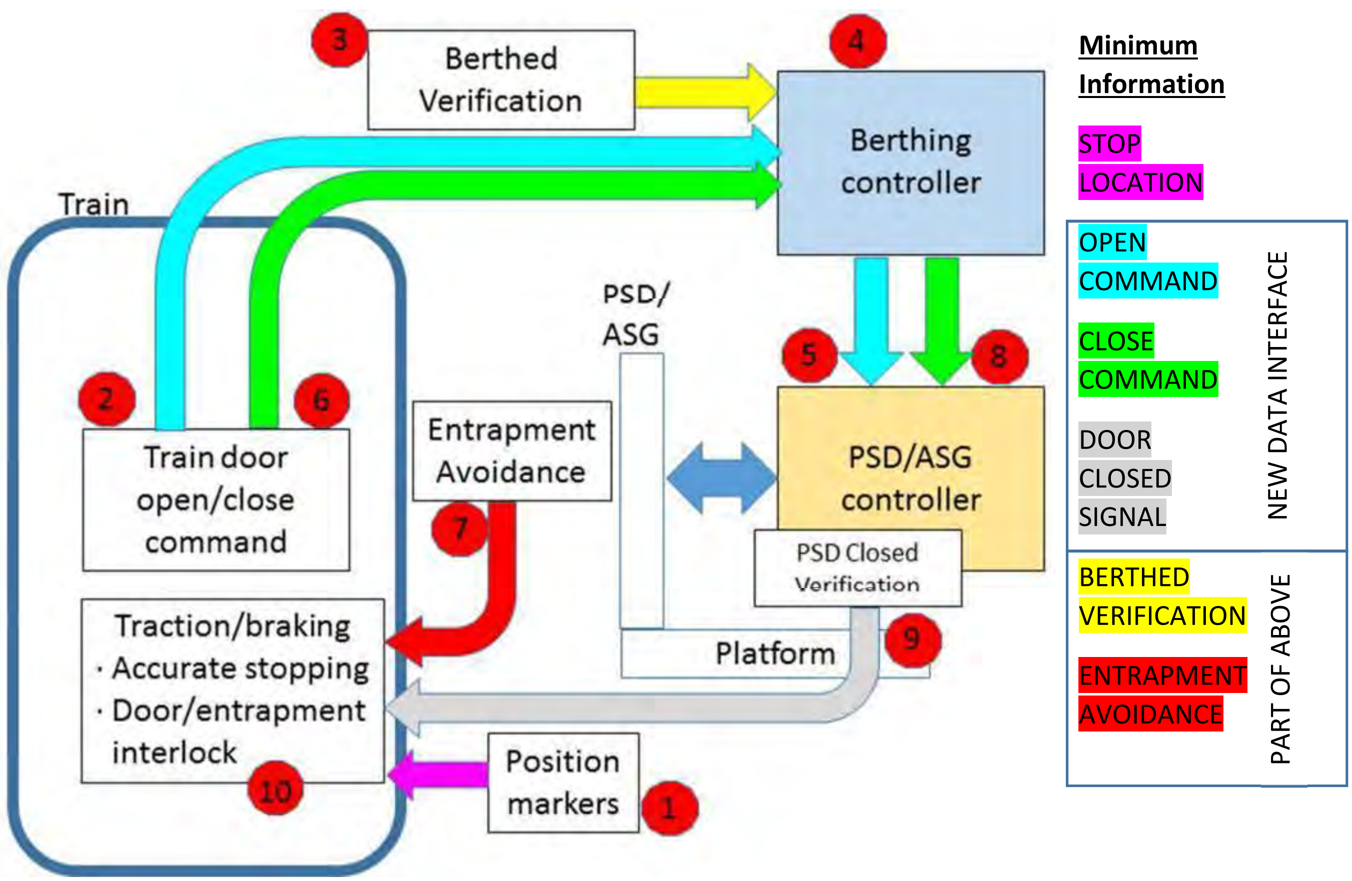
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



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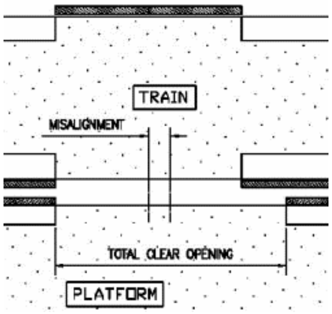
Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5” clear opening, a design for NY should meet the ADA Accessibility Guideline of 36”.

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a ‘distance totem’ which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy’s COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

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Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

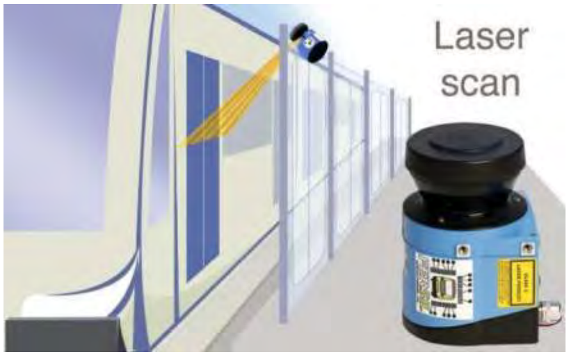
The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically

If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.



For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4'-0"). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

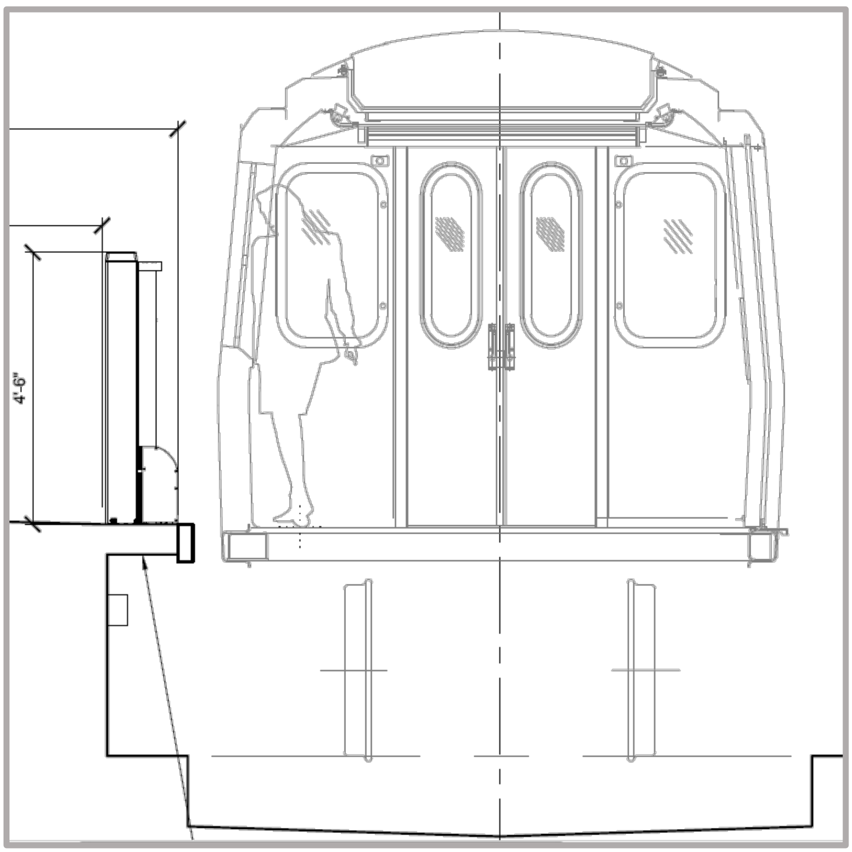


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

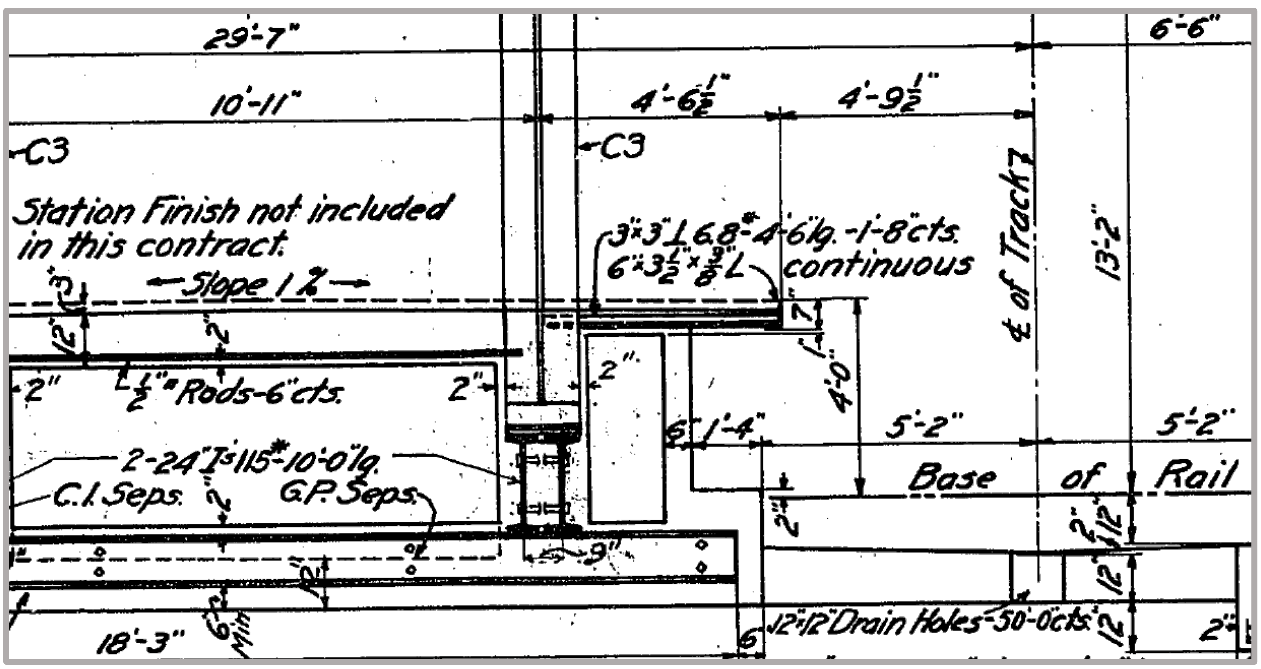


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

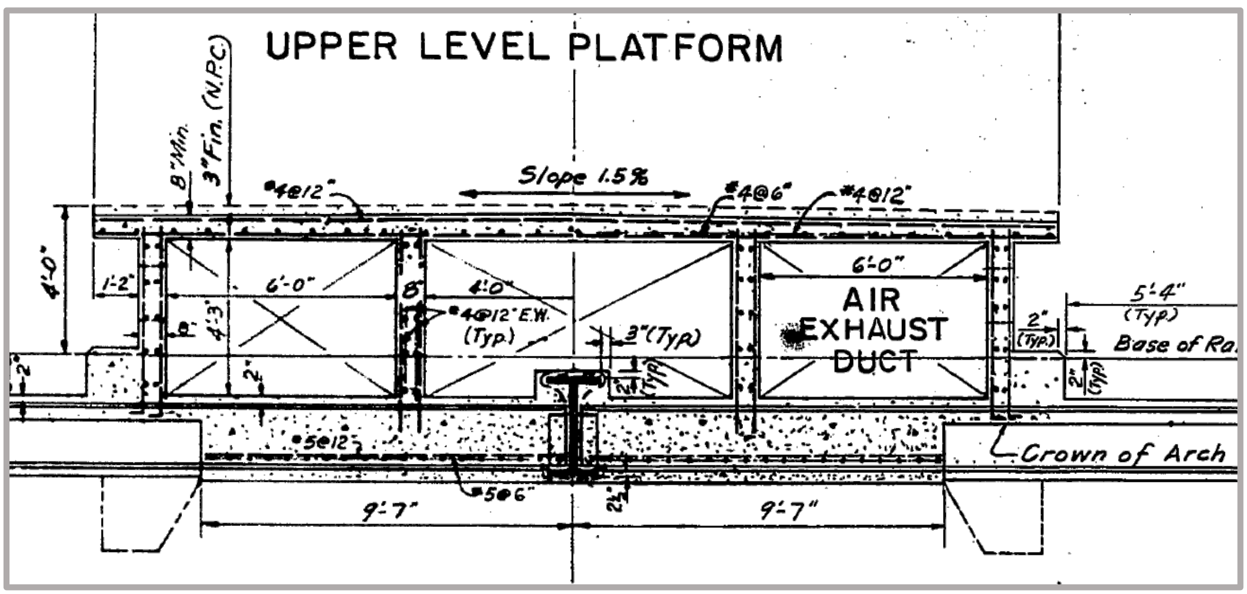


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

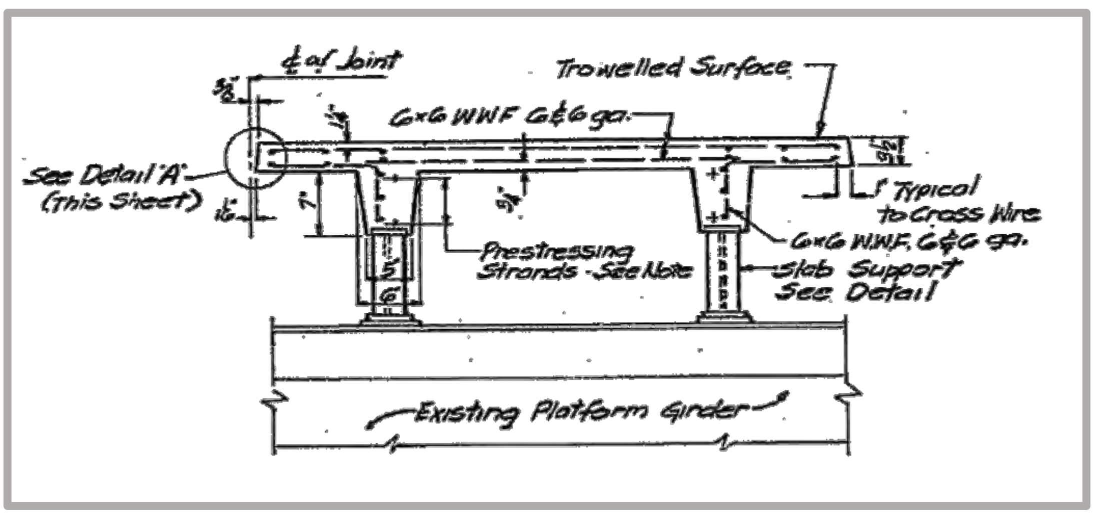


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

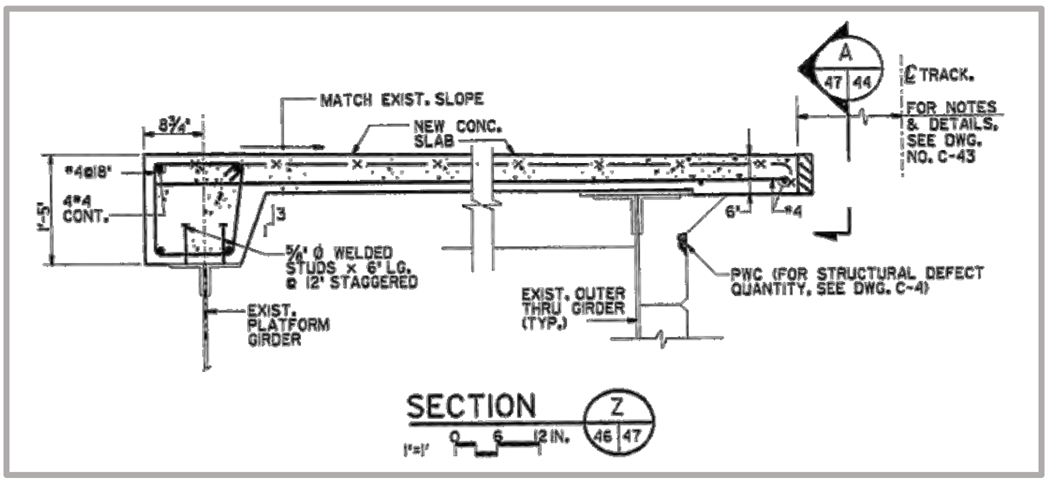


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2'-9"), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

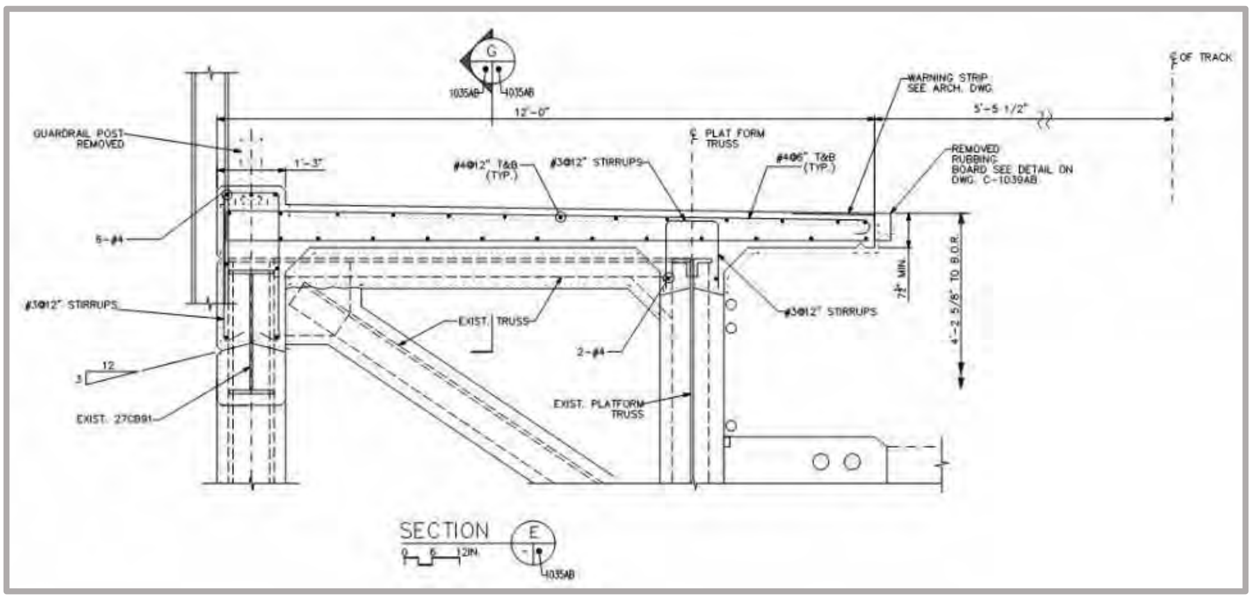


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3" thick structural slab with an approximately 3" thick topping slab. If the topping slab is fully removed, a 6" thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6" thick slab will be sufficient for a cantilever length of up to approximately 3'-0", greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6" structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6" minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

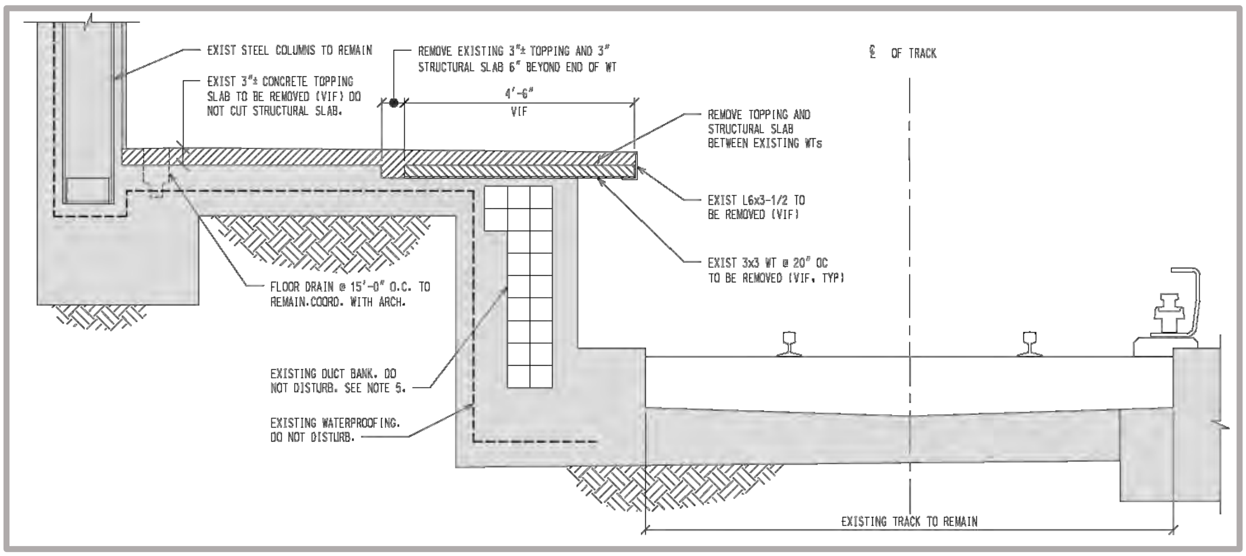


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

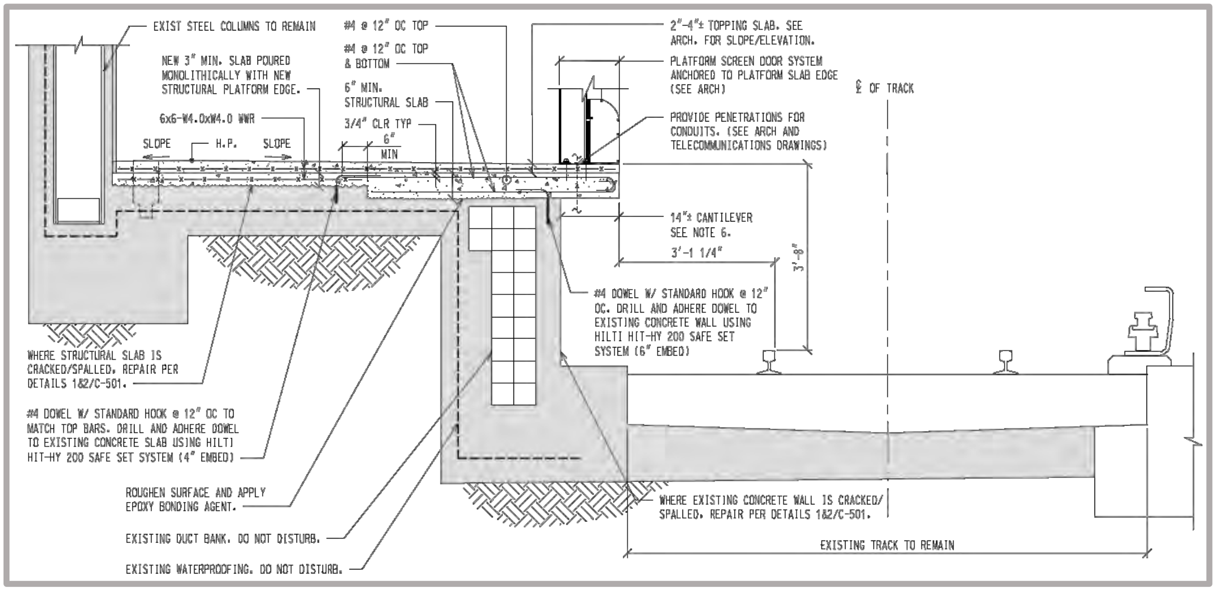


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

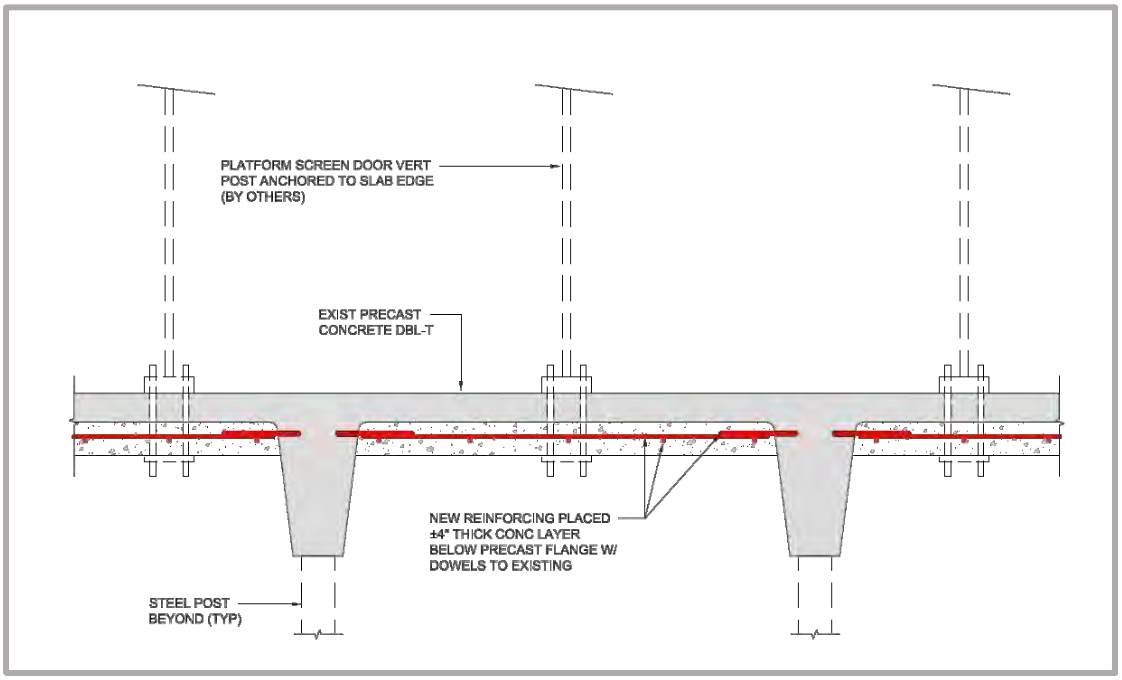


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

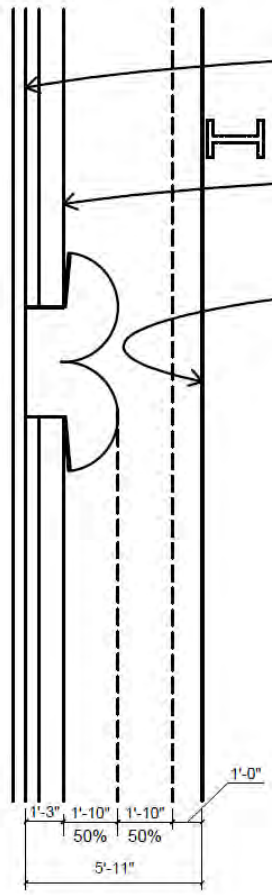
The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5' – 11" of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis



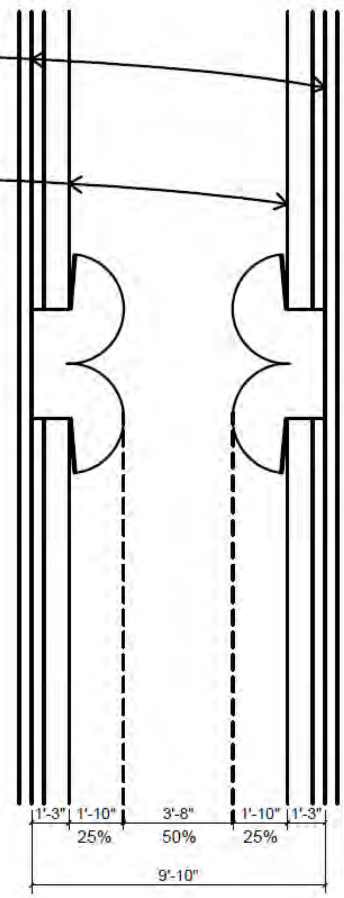


FIGURE 1: SIDE PLATFORM

FIGURE 2: CENTER PLATFORM

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

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MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the	9	$ 63,500 per month [Year 01]	$ 571,500		
	platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance	12	$ 83,590 per month [Year 02]	$ 1,003,080		
	since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
	remedial repair performed as needed, 24/7, for the	12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
	platform screen door system and ancillary equipment.					
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663		

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT
7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *	
		Year 3	$ 257 per hour *	
	Optional :	Year 4	$ 268 per hour *	
	Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

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VJ ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations
ESTIMATE DATE:	June 3, 2019

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VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

MTA/NYCT

June 3, 2019

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.2 *APGs / PSDs will provide 39 emergency egress doors with push bars per platform*
1.3 *Each platform edge will have 50 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 It is assumed that each train has 10 cars on this line
2.2 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.3 In respect of the PSD option, only platforms that have not been upgraded in the recent past will require platform edge replacement.
2.4 There are no special security requirements made necessary by installation of the APG system
2.5 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.6 This estimate does not provide for the replacement of Platform Edge Lighting
2.7 Premium cost for night time work is considered 50% of total labor cost

3.0 ***Exclusions - Costs not included in the estimate:***

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VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

MTA/NYCT

June 3, 2019

BASIS OF ESTIMATE

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems
3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length
3.4 Costs associated with NYCT State Of Good Repair improvements to the station
3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.
3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs
3.7 Escalation Cost is not included; Anticipate at 5% per annum.
3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.
3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium
3.10 NYCT project cost is not included
3.11 GO and flagging cost is not included
3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or “soft” costs:***

4.1 Design and Construction Contingency
4.2 Contractor O & P
4.3 Insurance
4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 Given the limited time available, no drawings were developed to support this estimate.

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MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

June 3, 2019

	ORDER OF MAGNITUDE COSTS		MRN 027	MRN 053	MRN 058	MRN 223	MRN 277
	DESCRIPTION		ATLANTIC AVE. BARCLAYS CTR.	125TH ST. NICHOLAS AVE.	174TH 175TH ST	167TH ST	7TH AVE
1	AUTOMATIC PLATFORM GATES (APG'S)		$16,629,898	$16,665,081	$17,063,278	$16,897,033	$17,244,660
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$16,629,898	$16,665,081	$17,063,278	$16,897,033	$17,244,660
4	GENERAL REQUIREMENTS	15.00%	$2,494,485	$2,499,762	$2,559,492	$2,534,555	$2,586,699
	SUB-TOTAL:		$19,124,382	$19,164,843	$19,622,770	$19,431,588	$19,831,360
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,781,096	$4,791,211	$4,905,693	$4,857,897	$4,957,840
	SUB-TOTAL:		$23,905,478	$23,956,054	$24,528,463	$24,289,485	$24,789,199
6	OVERHEAD & PROFIT	15.00%	$3,585,822	$3,593,408	$3,679,269	$3,643,423	$3,718,380
	SUB-TOTAL:		$27,491,300	$27,549,462	$28,207,732	$27,932,908	$28,507,579
7	BONDS & INSURANCE	3.75%	$1,030,924	$1,033,105	$1,057,790	$1,047,484	$1,069,034
	SUB-TOTAL:		$28,522,223	$28,582,567	$29,265,522	$28,980,392	$29,576,614
	SUBTOTAL CONSTRUCTION COST W/O ACM		**$28,522,223**	**$28,582,567**	**$29,265,522**	**$28,980,392**	**$29,576,614**
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		**$28,522,223**	**$28,582,567**	**$29,265,522**	**$28,980,392**	**$29,576,614**
10	DESIGN CONSULTANT FEES	10.00%	$2,852,222	$2,858,257	$2,926,552	$2,898,039	$2,957,661
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		**$31,374,446**	**$31,440,823**	**$32,192,074**	**$31,878,432**	**$32,534,275**
	ADD ALTERNATIVES						
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		4,531,048	5,307,455	4,472,714	4,354,544	$5,227,108
	Add for Markups (as above)	88.66%	4,017,358	4,705,743	3,965,637	3,860,864	4,634,505
	SUB-TOTAL PSD ALTERNATIVE		**$8,548,406**	**$10,013,199**	**$8,438,351**	**$8,215,408**	**$9,861,614**
	TOTAL PROJECT COST (PSD OPTION)		**$39,922,852**	**$41,454,022**	**$40,630,425**	**$40,093,840**	**$42,395,889**

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : ATLANTIC AVE. BARCLAYS CTR.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	618	LF		
5	LENGTH OF THE PLATFORM EDGE =	618	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,236**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,236	LF	7	8,652
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,180	SF	12	74,160
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,238	EA	25	30,950
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,238	EA	25	30,950
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,236	LF	95	117,420
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,236	LF	15	18,540
26	Remove existing platform tiles	1,236	LF	12	14,832
27	Sawcut existing topping concrete at perimeter of removal area	1,236	LF	5	6,180
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,416	SF	8	59,328
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-0" wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,236	SF	15	18,540

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STATION : ATLANTIC AVE. BARCLAYS CTR.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Platform column restructuring**				
37	Demolition				
38	Install, maintain and remove temporary support	2	LS	15,000	30,000
39	Breakout existing platform slab for new column	2	LS	5,000	10,000
40	New Work				
41	Excavate for foundation for new column	2	EA	1,500	3,000
42	Foundation for new column	2	EA	5,000	10,000
43	New structural steel column	2	EA	20,000	40,000
44	Extend and repair beams above	2	LS	5,000	10,000
45	Grillage	2	EA	10,000	20,000
46					
47	**Equipment Room [7'-0" x 27'-6"]**				
48	Build off existing mezzanine slab		Note		
49	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
50	CMU Wall for equipment room	415	SF	45	18,675
51	Vertical connections with existing structure	20	LF	25	500
52	Roof for equipment room	193	SF	30	5,775
53	Fire rated door including frame & hardware	1	EA	2,500	2,500
54	Exterior wall finish				
55	Ceramic Tiling to match existing	415	SF	40	16,600
56	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
57	Concrete cove to match existing	42	LF	20	830
58	Interior Wall Finish - Paint	690	SF	5	3,450
59	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
60	Allow for 4" thick concrete pads for equipment	48	SF	20	963
61	Allowance for Mechanical Scope	1	LS	40,000	40,000
62	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
63	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
64	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
65					
66	**Automatic Platform Gates [APGs] - 4'-6" High**				
67	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
68	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
69	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
70	Platform End Gates (PEGs)	4	EA	13,000	52,000
71	Fixed Panels including framing and support; 4'-6" High	2,277	SF	750	1,707,750
72	Spare Parts - Approx. 10% of Material Cost	1	LS	229,125	229,125

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : ATLANTIC AVE. BARCLAYS CTR.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
73	Testing and commissioning	800	HRS	160	127,944
74	Product Warranty	1	LS	1,000,000	1,000,000
75	Allowance for Braille Signage	80	EA	2,500	200,000
76					
77	**Electrical**				
78	Electrical Upgrades				
79	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
80	Power and Lighting				
81	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
82	Allow for conduit / cable runs for power and communications under platform edge	1,236	LF	60	74,160
83	PSD Connections	1	LS	75,000	75,000
84	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
85	Power to PSD Room from EDR [Conduit & Cable]	200	LF	60	12,000
86	Reserve power to PSD Room from EDR [Conduit & Cable]	250	LF	60	15,000
87	No allowance for new lighting as if APG's are used		Note		EXCL.
88	Grounding				
89	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
90	MISC				
91	Testing and commissioning	1	EA	30,000	30,000
92	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
93					
94	**Communications**				
95	FA System				
96	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
97	CCTV coverage				
98	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
99	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
100	Berthing Technology Sensors				
101	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
102	Train Door Detection System				
103	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
104	Entrapment concerns				
105	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
106	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
107	Engineering and Testing	1,000	Hrs	160	159,930
108	Centralized monitoring/control				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : ATLANTIC AVE. BARCLAYS CTR.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
109	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
110	MISC				
111	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
112	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
113	Site Survey and Inspections	1	LS	100,000	100,000
114	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
115	Furnish Test Equipment allowance	1	LS	500,000	500,000
116	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
117					
118	Training				
119	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
120					
121	Out of hours Work				
122	Allow loss of production to work at night say 50%	1	LS	3,837,669	3,837,669
123					
124	TOTAL PSD WORK:				$ 16,629,898
126					
127	ADD ALTERNATIVE				
128					
129	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
130					
131	ADD				
132	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
133	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
134	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
135	Platform End Gates (PEGs)	4	EA	18,000	72,000
136	Fixed Panels including framing and support; Assuming 8'-0" high	5,022	SF	750	3,766,365
137	Spare Parts - Approx. 10% of Material Cost	1	LS	424,102	424,102
138	Structual framing / bracing				
139	HSS4x4x1/2 hanger	5	TONS	17,500	82,049
140	L6x6x1/2 continuous angle	9	TONS	17,500	159,197
141	Drilling and bolting - 4 bolts at each connection	494	EA	216	106,790
142	Platform Edge Repair				
143	Remove concrete platform edge				Previously done
144	Platform edge repair				Previously done
145	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : ATLANTIC AVE. BARCLAYS CTR.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
146	Signal Work [Each 300' length is associated with one signal light]				
147	Disconnects	80	HRS	162	12,960
148	Remove signal cables	600	LF	40	24,000
149	Remove conduit; Assuming 1"	600	LF	55	33,000
150	Install conduit in new position	600	LF	110	66,000
151	Install replacement cable; assumed single cable #12	600	LF	125	75,000
152	Re-commission / testing as required	2	EA	12,500	25,000
153	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
154	Premium Time	1,569	HRS	49	76,253
155					
156	OMIT				
157	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
158	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
159	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
160	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
161	Fixed Panels including framing and support; 4'-6" High	(2,277)	SF	750	(1,707,750)
162	Spare Parts - Approx. 10% of Material Cost	(1)	LS	229,125	(229,125)
163	Platform Edge Reconstruction work	(1)	LS	561,260	(561,260)
164	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
165	Conduit running under Platform Edge	(1,236)	LF	30	(37,080)
166					
167	Allow loss of production to work at night say 50%	1	LS	1,045,626	1,045,626
168					
169	PREMIUM ASSOCIATED WITH PSD's				$ 4,531,048

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 125TH ST. NICHOLAS AVE.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	634	LF		
5	LENGTH OF THE PLATFORM EDGE =	634	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,268**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,268	LF	7	8,876
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,340	SF	12	76,080
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	128	CY	2,500	320,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,270	EA	25	31,750
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,270	EA	25	31,750
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,268	LF	95	120,460
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,268	LF	15	19,020
26	Remove existing platform tiles	1,268	LF	12	15,216
27	Sawcut existing topping concrete at perimeter of removal area	1,268	LF	5	6,340
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,608	SF	8	60,864
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 7'-0" wide	560	SF	8	4,480
30	New Work				
31	New concrete topping to match existing	1,268	SF	15	19,020

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 125TH ST. NICHOLAS AVE.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	560	SF	15	8,400
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,421	SF	750	1,815,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	235,605	235,605
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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STATION : 125TH ST. NICHOLAS AVE.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,268	LF	60	76,080
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	300	LF	60	18,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	350	LF	60	21,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 125TH ST. NICHOLAS AVE.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,845,788	3,845,788
112					
113	TOTAL PSD WORK:				$ 16,665,081
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,278	SF	750	3,958,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	435,622	435,622
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	84,140
129	L6x6x1/2 continuous angle	9	TONS	17,500	163,318
130	Drilling and bolting - 4 bolts at each connection	507	EA	216	109,555
131	Platform Edge Repair				
132	Remove concrete platform edge	1,268	LF	27	34,236
133	Platform edge repair	1,268	LF	109	138,212
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	624	EA	10	6,240
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	160	HRS	162	25,920
137	Remove signal cables	1,200	LF	40	48,000
138	Remove conduit; Assuming 1"	1,200	LF	55	66,000
139	Install conduit in new position	1,200	LF	110	132,000
140	Install replacement cable; assumed single cable #12	1,200	LF	125	150,000
141	Allow for remove and reinstall conductor boxes	2	EA	3,000	6,000
142	Re-commission / testing as required	4	EA	12,500	50,000
143	Engineering / Shop Drawings / Etc.	4	EA	7,500	30,000
144	Premium Time	3,175	HRS	49	154,305

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 125TH ST. NICHOLAS AVE.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
149	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
150	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
151	Fixed Panels including framing and support; 4'-6" High	(2,421)	SF	750	(1,815,750)
152	Spare Parts - Approx. 10% of Material Cost	(1)	LS	235,605	(235,605)
153	Platform Edge Reconstruction work	(1)	LS	574,780	(574,780)
154	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
155	Conduit running under Platform Edge	(1,268)	LF	30	(38,040)
156					
157	Allow loss of production to work at night say 50%	1	LS	1,224,797	1,224,797
158					
159	PREMIUM ASSOCIATED WITH PSD's				$ 5,307,455

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 174TH 175TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	671	LF		
5	LENGTH OF THE PLATFORM EDGE =	671	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,342**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,342	LF	7	9,394
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,710	SF	12	80,520
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	135	CY	2,500	337,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,344	EA	25	33,600
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,344	EA	25	33,600
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,342	LF	95	127,490
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,342	LF	15	20,130
26	Remove existing platform tiles	1,342	LF	12	16,104
27	Sawcut existing topping concrete at perimeter of removal area	1,342	LF	5	6,710
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,052	SF	8	64,416
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 8'-7" wide	687	SF	8	5,493
30	New Work				
31	New concrete topping to match existing	1,342	SF	15	20,130

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 174TH 175TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	687	SF	15	10,300
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,754	SF	750	2,065,500
61	Spare Parts - Approx. 10% of Material Cost	1	LS	250,590	250,590
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 174TH 175TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,342	LF	60	80,520
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	250	LF	60	15,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	300	LF	60	18,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 174TH 175TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,937,680	3,937,680
112					
113	TOTAL PSD WORK:				$ 17,063,278
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,870	SF	750	4,402,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	462,262	462,262
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	88,974
129	L6x6x1/2 continuous angle	10	TONS	17,500	172,850
130	Drilling and bolting - 4 bolts at each connection	537	EA	216	115,949
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 174TH 175TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,754)	SF	750	(2,065,500)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	250,590	(250,590)
152	Platform Edge Reconstruction work	(1)	LS	600,420	(600,420)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,342)	LF	30	(40,260)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,032,165	1,032,165
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,472,714

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 167TH ST

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	659	LF		
5	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	659	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,318**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,318	LF	7	9,226
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,590	SF	12	79,080
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,320	EA	25	33,000
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,320	EA	25	33,000
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,318	LF	95	125,210
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,318	LF	15	19,770
26	Remove existing platform tiles	1,318	LF	12	15,816
27	Sawcut existing topping concrete at perimeter of removal area	1,318	LF	5	6,590
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,908	SF	8	63,264
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 5'-9" wide	460	SF	8	3,680
30	New Work				
31	New concrete topping to match existing	1,318	SF	15	19,770
32	New concrete topping at ADA boarding area to match existing	460	SF	15	6,900

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 167TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [12'-0" x 16'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,646	SF	750	1,984,500
61	Spare Parts - Approx. 10% of Material Cost	1	LS	245,730	245,730
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
71	Allow for conduit / cable runs for power and communications under platform edge	1,318	LF	60	79,080

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 167TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
74	Power to PSD Room from EDR including track crossing if needed	100	LF	60	6,000
75	Reserve power to PSD Room from EDR including track crossing if needed	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
79	MISC				
80	Testing and commissioning	1	LS	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

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STATION : 167TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,899,315	3,899,315
113	TOTAL PSD WORK:				$ 16,897,033

115					
116	**ADD ALTERNATIVE**				
117					
118	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
119					
120	**ADD**				
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,678	SF	750	4,258,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	453,622	453,622
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	87,406
129	L6x6x1/2 continuous angle	10	TONS	17,500	169,758
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 167TH ST

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,646)	SF	750	(1,984,500)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	245,730	(245,730)
152	Platform Edge Reconstruction work	(1)	LS	592,780	(592,780)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,318)	LF	30	(39,540)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,004,895	1,004,895
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				**4,354,544**

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 7TH AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE UPPER PLATFORM EDGE [SOUTH BOUND] =	658	LF		
5	LENGTH OF THE LOWER PLATFORM EDGE [NORTH BOUND] =	658	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,315**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,315	LF	7	9,205
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,575	SF	12	78,900
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	132	CY	2,500	330,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,317	EA	25	32,925
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,317	EA	25	32,925
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,315	LF	95	124,925
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,315	LF	15	19,725
26	Remove existing platform tiles	1,315	LF	12	15,780
27	Sawcut existing topping concrete at perimeter of removal area	1,315	LF	5	6,575
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,890	SF	8	63,120
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,315	SF	15	19,725

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 7TH AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room Upper Platform Level [6'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	61	LF	90	5,445
39	CMU Wall for equipment room	605	SF	45	27,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	176	SF	30	5,265
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	605	SF	40	24,200
45	Mosaic Band to match existing - Assuming 8" high	61	LF	120	7,260
46	Concrete cove to match existing	61	LF	20	1,210
47	Interior Wall Finish - Paint	605	SF	5	3,025
48	Allow for Misc. floor & ceiling finishes	176	SF	15	2,633
49	Allow for 4" thick concrete pads for equipment	44	SF	20	878
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,633	SF	750	1,974,375
61	Spare Parts - Approx. 10% of Material Cost	1	LS	245,123	245,123
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 7TH AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,315	LF	60	78,900
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	650	LF	60	39,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	700	LF	60	42,000
76	Allowance for power to cross tracks to opposite platform [Upper level]	1	LS	15,000	15,000
77	Allowance for power to cross tracks to opposite platform [Lower level]	1	LS	15,000	15,000
78	No allowance for new lighting as if APG's are used		Note		EXCL.
79	Grounding				
80	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
81	MISC				
82	Testing and commissioning	1	EA	30,000	30,000
83	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
84					
85	**Communications**				
86	FA System				
87	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
88	CCTV coverage				
89	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
90	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
91	Berthing Technology Sensors				
92	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
93	Train Door Detection System				
94	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
95	Entrapment concerns				
96	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
97	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
98	Engineering and Testing	2,000	Hrs	160	319,860
99	Centralized monitoring/control				
100	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 7TH AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
101	MISC				
102	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
103	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
104	Site Survey and Inspections	1	LS	100,000	100,000
105	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
106	Furnish Test Equipment allowance	1	LS	500,000	500,000
107	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
108					
109	Training				
110	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
111					
112	Out of hours Work				
113	Allow loss of production to work at night say 50%	1	LS	3,979,537	3,979,537
115	TOTAL PSD WORK:				$ 17,244,660

117					
118	ADD ALTERNATIVE				
119					
120	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
121					
122	ADD				
123	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
124	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
125	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
126	Platform End Gates (PEGs)	4	EA	18,000	72,000
127	Fixed Panels including framing and support; Assuming 8'-0" high	5,654	SF	750	4,240,365
128	Spare Parts - Approx. 10% of Material Cost	1	LS	452,542	452,542
129	Structual framing / bracing				
130	HSS4x4x1/2 hanger	5	TONS	17,500	87,210
131	L6x6x1/2 continuous angle	10	TONS	17,500	169,372
132	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
133	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long	1	LS	350,000	350,000
134	Platform Edge Repair				
135	Remove concrete platform edge				Previously done
136	Platform edge repair				Previously done
137	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
138	Signal Work [Each 300' length is associated with one signal light]				
139	Disconnects	80	HRS	162	12,960
140	Remove signal cables	600	LF	40	24,000
141	Remove conduit; Assuming 1”	600	LF	55	33,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for D - Line Stations

3-Jun-19

STATION : 7TH AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Install conduit in new position	600	LF	110	66,000
143	Install replacement cable; assumed single cable #12	600	LF	125	75,000
144	Re-commission / testing as required	2	EA	12,500	25,000
145	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
146	Premium Time	1,569	HRS	49	76,253
147					
148	OMIT				
149	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
150	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
151	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
152	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
153	Fixed Panels including framing and support; 4'-6" High	(2,633)	SF	750	(1,974,375)
154	Spare Parts - Approx. 10% of Material Cost	(1)	LS	245,123	(245,123)
155	Platform Edge Reconstruction work	(1)	LS	589,950	(589,950)
156	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
157	Conduit running under Platform Edge	(1,315)	LF	30	(39,450)
158					
159	Allow loss of production to work at night say 50%	1	LS	1,206,256	1,206,256
160					
161					
162	**PREMIUM ASSOCIATED WITH PSD's**				**5,227,108**

New York City Transit

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REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR 'F' LINE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

SUBMITTAL DATE: December 19, 2018

STV 100 Years

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Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 45 newly evaluated stations, 40 have been found to be not suitable for the installation of PSDs.

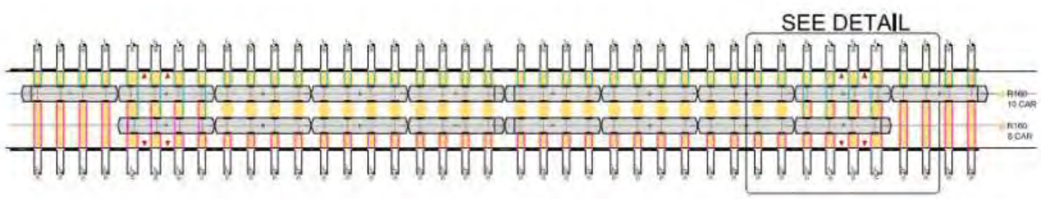
[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to low-height barriers]

The following points summarize the major constraints to installing a PSD system:

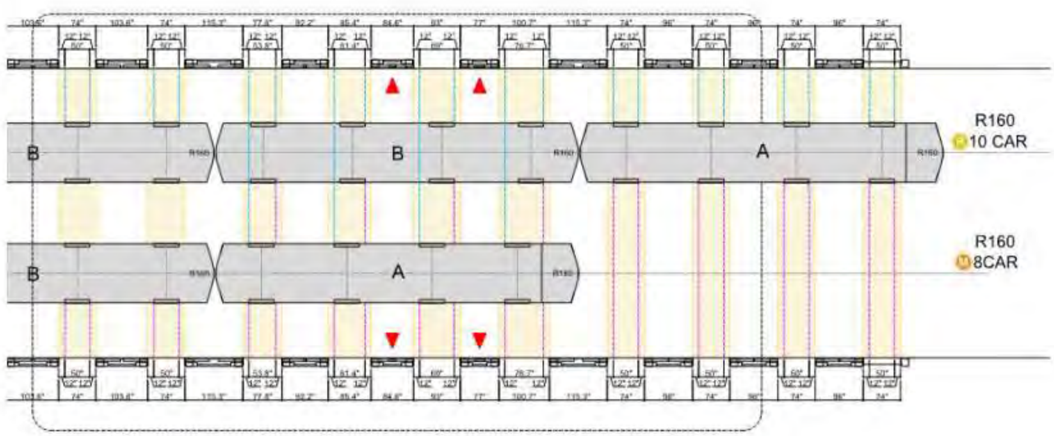
- ADA clearance issues; the platform edge barriers are 15" wide. Where an existing object (wall, stair, railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Where these PSDs hamper the ability of a wheelchair to turn (a 5'-0" circle) and/or limit path of travel to less than 32" pinch width, it is declared infeasible. This requirement dictates that if a column or any obstruction measuring less than or equal to 24" in the direction of circulation is present, it may not constrain the circulation path to less than 32".
- Insufficient space for the PSD equipment room; the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow; due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements in regard to the placement of these new barriers in an existing station environment.
- Structural considerations; existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit. There are structural anomalies affecting the ability of platform edges to support PSD loads occurring at the three stations on the 63rd Street line as well as at three stations on the 6th Avenue line. These stations required a further structural analysis that can be found in the station specific reports.

- Car door misalignment (part of Tier 1 selection process): Presently (2018) the NYCT system features three car geometries on the A Division and three car geometries on the B Division. With few exceptions, these cars are freely mixed between lines. The spacing of doors on these differing cars is significantly misaligned, making the installation of platform doors infeasible. Looking to the future, NYCT plans to procure new rolling stock with identical or nearly identical door spacing. The current procurement schedule indicates the purchase of these geometrically compatible cars by 2032. Therefore, our assessment of feasibility is based on the year 2032.

  However, the F-line service and an overlapping service on the B Division will remain incompatible even after 2032. The F is a ten-car train, whereas the M line is an eight-car train. The newer trains are assembled in two consists, with a driver / conductor cabin at the front and back of each consist. Due to the cabin, the spacing of doors on the first and last car differs from the door spacing of the other cars of the train. Therefore, there will inevitably be a mismatching of doors as these two differing train types berth at a certain station platform. The M train cannot be extended to a ten-car length because all the station stops in Brooklyn feature station platforms of an eight-car length. Therefore, 17 of the 45 stations on the F-line are infeasible due to this incompatibility. Please see the diagrams in Figure 1 below.



Overall view of 10-car train versus 8-car train



Detail view of "A" car (with driver cabin) and "B" car. Sliding PSD doors cannot cover the wide openings required to cover both train door locations at the first two doors. A similar misalignment occurs at the rear of the train.

LEGEND
▲ SPACE BETWEEN DOOR OPENINGS IS INSUFFICIENT IN LENGTH TO ACCOMODATE SLIDING DOORS.

Figure 1 *– Ten-car vs. eight-car train Comparison of door geometry*

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the wall and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

Please note: Electrical capacity is not considered as a factor affecting feasibility in the installation of a future APG or PSD system in this study. Inadequate electrical capacity is observed as a factor that will increase the cost of installing a future APG or PSD system.

A garbage train is used for refuse removal on the 'F' Line. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the (off) loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in damage from these carts along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process.

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 11% of the 'F' Line stations. Total implementation cost would be $159.2M for APGs and $202.1M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; That estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of $931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 5 feasible stations, the aggregate annual maintenance cost would be $4,655,000.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'F' Line Stations

'F' Line Summary of Feasibility (11% feasible; 5/45)

No.	Station Name	Station Type	Platform Type	Feasible Yes / No	Issues / Reason for Failure	Cost APGs	Cost PSDs
MR-254	Jamaica- 179th Street	Below-grade	Center/Island	No	ADA clearance		
MR-255	169th Street	Below-grade	Side	No	ADA clearance		
MR-256	Parsons Boulevard	Below-grade	Side	No	ADA clearance		
MR-257	Sutphin Boulevard	Below-grade	Side	No	ADA clearance		
MR-258	Briarwood	Below-grade	Side	No	ADA clearance		
MR-259	Kew Gardens-Union Turnpike	Below-grade	Center/Island	No	ADA clearance		
MR-260	75th Avenue	Below-grade	Side	No	ADA clearance		
MR-261	Forest Hill- 71st Avenue	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment		
MR-267	Roosevelt Ave- Jackson Heights	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment		
MR-221	21st Street- Queensbridge	Below-grade	Center/Island	Yes		$31.4M	$39.8M
MR-222	Roosevelt Island	Below-grade	Side	Yes		$31.5M	$40.8M
MR-223	Lexington Ave-63rd Street	Below-grade	Center/Island	Yes		$31.6M	$39.3M
MR-224	57th Street	Below-grade	Center/Island	No	ADA clearance		
MR-225	47-50 Streets- Rockefeller Center	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment		
MR-226	42nd Street- Bryant Park	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment		
MR-227	34th Street-Herald Square	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment		
MR-228	23rd Street	Below-grade	Side	No	Tier 1 Failure- train door misalignment		
MR-229	14th Street	Below-grade	Side	No	Tier 1 Failure- train door misalignment		
MR-230	West 4th Street	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment		
MR-231	Broadway-Lafayette Street-Bleecker Street	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment		
MR-232	2nd Avenue	Below-grade	Center/Island	No	ADA clearance		
MR-233	Delancey Street	Below-grade	Side	No	ADA clearance		
MR-234	East Broadway	Below-grade	Center/Island	No	ADA clearance		
`MR-235	York Street	Below-grade	Center/Island	Yes		$32.5M	$41.2M
MR-174	Jay Street-Metro Tech	Below-grade	Center/Island	No	ADA clearance		
MR-236	Bergen Street	Below-grade	Side	No	Tier 1 Failure- train door misalignment		
MR-237	Carroll Street	Below-grade	Side	No	Tier 1 Failure- train door misalignment		
MR-238	Smith-9th Streets	Elevated	Side	No	Tier 1 Failure- train door misalignment		
MR-239	4th Avenue	Elevated	Side	No	Tier 1 Failure- train door misalignment & ADA clearance		
MR-240	7th Avenue	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment		
MR-241	15th Street-Prospect Park	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment & ADA clearance		
MR-242	Fort Hamilton Parkway	Below-grade	Side	No	Tier 1 Failure- train door misalignment & Equipment room		
MR-243	Church Avenue	Below-grade	Center/Island	No	Tier 1 Failure- train door misalignment & ADA clearance		
MR-244	Ditmas Avenue	Elevated	Side	No	Precast platform (Appendix B)*		
MR-245	18th Avenue	Elevated	Center/Island	No	Precast platform (Appendix B)*		
MR-246	Avenue I	Elevated	Side	No	Precast platform (Appendix B)*		
MR-247	Bay Parkway	Elevated	Center/Island	No	Precast platform (Appendix B)		
MR-248	Avenue N	Elevated	Side	No	Precast platform (Appendix B)*		
MR-249	Avenue P	Elevated	Side	No	Precast platform (Appendix B)*		
MR-250	Kings Highway	Elevated	Center/Island	No	Precast platform (Appendix B)		
MR-251	Avenue U	Elevated	Side	No	Precast platform (Appendix B)		
MR-252	Avenue X	Elevated	Side	No	Precast platform (Appendix B)*		
MR-253	Neptune Ave	Elevated	Center/Island	No	Precast platform (Appendix B)*		
MR-057	West 8th Street- New York Aquarium	Elevated	Side	No	ADA clearance		
MR-058	Stillwell Ave- Coney Island	Elevated	Center/Island	Yes		$32.2M	$41.0M
					Total Estimated Cost	**$159.2M**	**$202.1M**

1.0 Station Assessments

1.1 MR-254 | Jamaica-179th Street Station

Summary: *Jamaica-179th Street Station (MR-254) is not feasible for both APGs and PSDs. This station is not feasible because the implementation of a platform edge barrier would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" width requirement for ADA compliant wheelchair movement would not be met at all stairs. Remaining widths would be approximately 25" (see figure 1).*

Description

Jamaica-179th Street Station is a below-grade terminus station serving the E and F trains. The station has two straight center/island platforms that are slightly tapered at the south-end of the station. Both platforms have one track dedicated to F-train service. The cast-in-place concrete platforms are accessed via the mezzanine. There are five stairs on the northbound platform & six stairs on the southbound platform. The platforms are approximately 19'-6" wide, but taper to a narrow 7'-0" at the south-end of the platform. Column spacing along the length of the platform is approximately 15' on center and column faces are typically 3'-4" to the edge of the platform. Currently, at all stairs along the length of the platform, a wheel chair can move between the columns and the platform edge (3'-4"). The implementation of a platform edge barrier would result in non-compliant ADA conditions that would not permit wheelchair movement along the length of the platform.

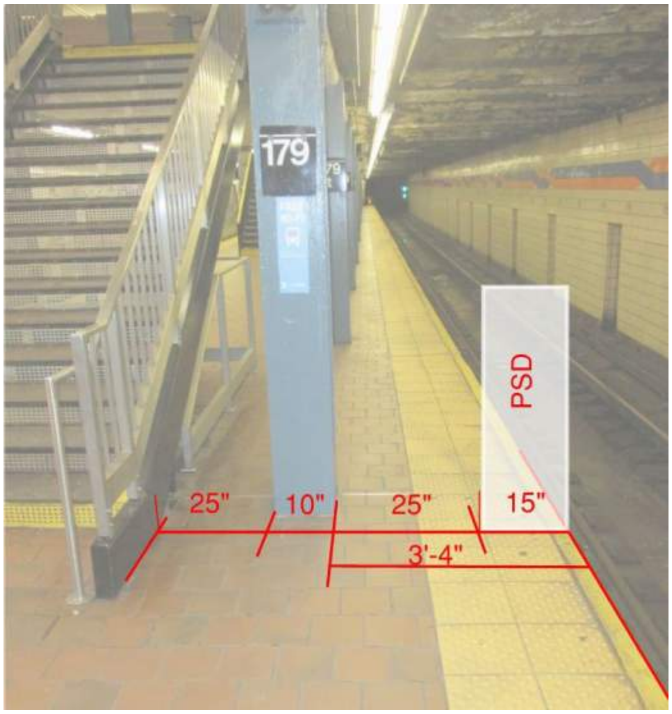


Figure 1 – Non-compliant ADA condition at stairs (typical)- Jamaica-179th Street Station

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1.2 MR-255 | 169th Street Station

Summary: *169th Street Station (MR-255) is not feasible for both APGs and PSDs as their implementation would create non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" width requirement for ADA compliant wheelchair movement would not be met at all stairs. Remaining widths would be approximately 25" (see figure 1).*

Description

169th Street Station is a below-grade station with two straight side platforms. The platform structure is cast-in-place concrete. The width of the side platforms are approximately 11'-4". Columns are spaced 15' on center and columns faces are 3'-4" from the edge of the platform. There is typically 2'-0" between the column and railing at all staircases. There are five staircases along each platform, all of which would not comply with the 32" width requirement for wheelchair movement. Columns divide the path between the stairs and the platform edge. Passengers requiring an ADA-compliant path of travel can currently move along the platform in the 3'-4" between columns and the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 25" would not allow for ADA compliant wheelchair movement.

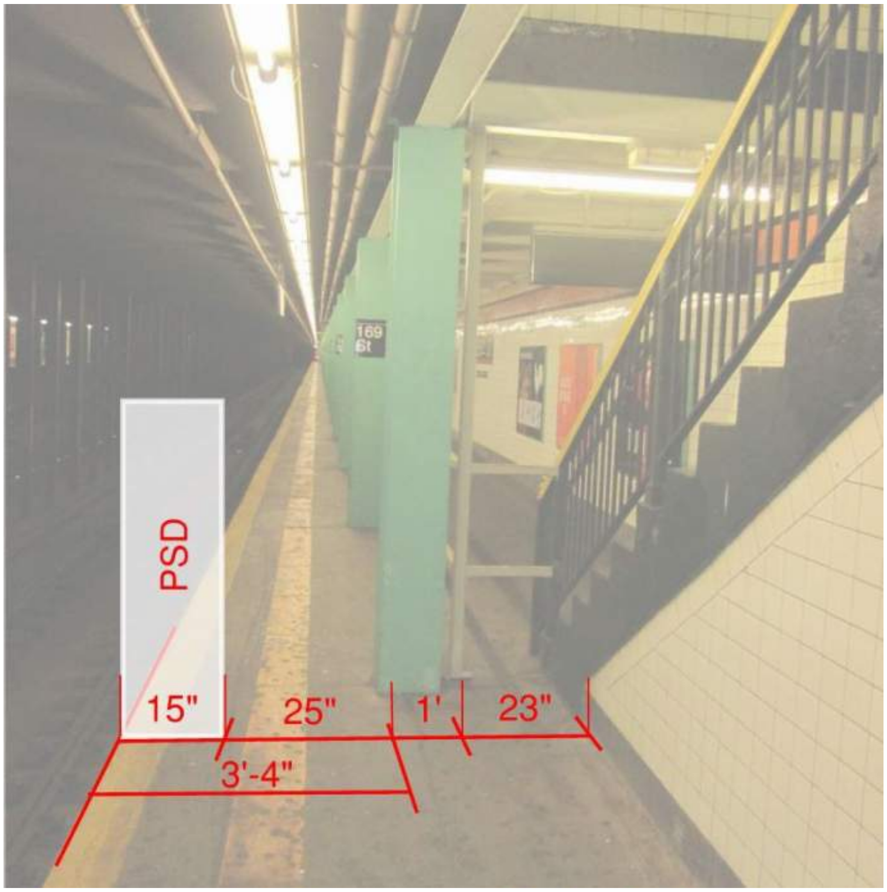

Figure 1 – Non-compliant ADA condition at stairs (typical)- 169th Street Station

1.3 MR-256 | Parsons Boulevard Station

Summary: *Parsons Boulevard Station (MR-256) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1). This condition occurs at all stairs on the local track edge of both platforms.*

Description

Parsons Boulevard Station is a below-grade station with two straight center/island platforms. The platform structure is cast-in-place concrete. The width of both platforms is approximately 19'-6". There are five staircases along each platform, all of which would not allow for the 32" width required for wheelchair movement with PSDs installed. Columns are spaced 15' on center with column faces 3'-4" away from all platform edges. The stairs are not centered on the platform, but shifted towards the local track edges. These stair are flanked on one side by the typical station column (3'-4" from the platform edge). Typically, the stairs are 9' from the express platform edge. See figure 2 for typical edge conditions at local and express sides of the platform. Passengers requiring an ADA-compliant path of travel can currently move along the platform in the 3'-4" between columns and the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 25" would not allow for ADA compliant wheelchair movement.

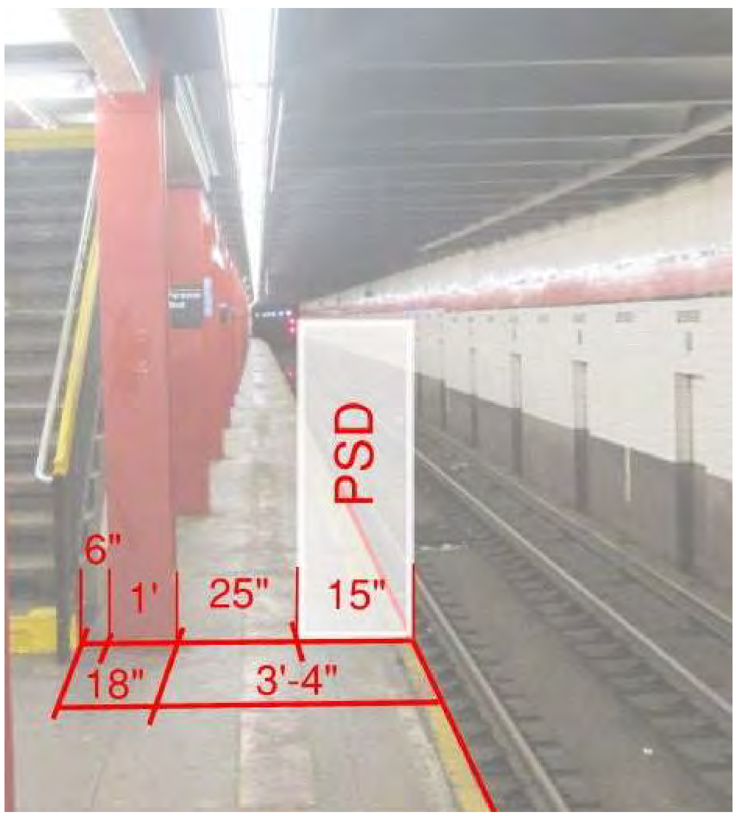

Figure 1 – Non-compliant ADA condition at stair (typical on local edge only) – Parsons Blvd. Station

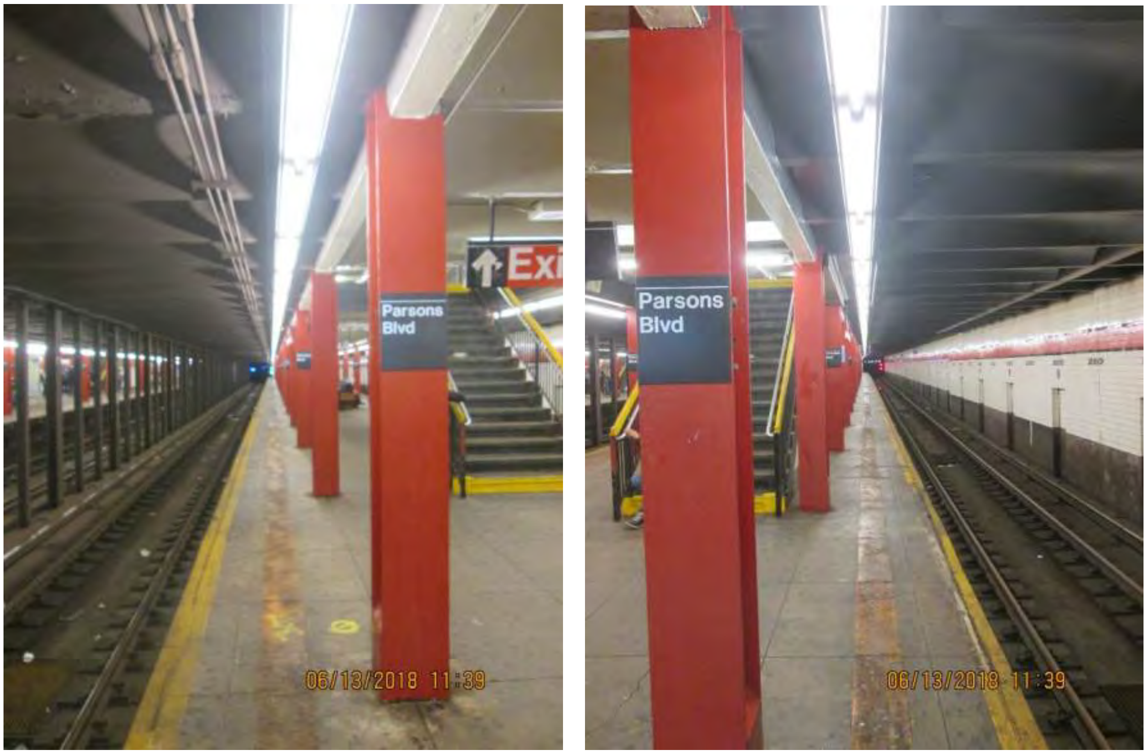

Figure 2 – Typical edge conditions | Express condition (left) and local condition (right)– Parsons Blvd. Station

1.4 MR-257 | Sutphin Boulevard Station

Summary: *Sutphin Boulevard Station (MR-257) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1). This condition would occur at all stairs on both platforms.*

Description

Sutphin Boulevard Station is a below-grade station with two straight side platforms. The platform structure is cast-in-place concrete. The width of both platforms is approximately 11'-4". There are six staircases along each platform, all of which would not allow for the 32" width required for wheelchair movement with PSDs installed. Columns divide the path between the stairs and the platform edge. Column spacing along the length of the platform is approximately 15' on center and column faces are typically 3'-4" to the edge of the platform. Currently, there is an ADA-compliant path of travel between columns and the platform edge (3'-4"). The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 25" would not allow for ADA compliant wheelchair movement.

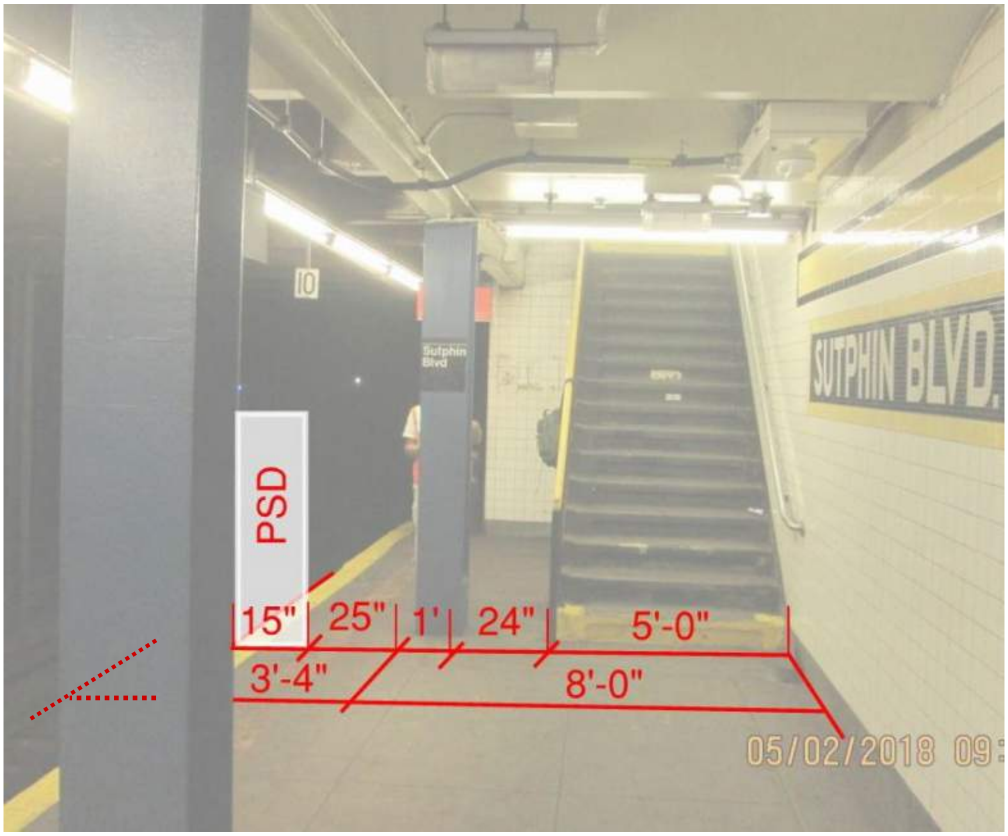

Figure 1 – Non-compliant ADA condition at stairs (typical)- Sutphin Blvd. Station

1.5 MR-258 | Briarwood Station

Summary: *Briarwood Station (MR-258) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 23" (see figure 1). This condition occurs at all stairs on both platforms.*

Description

Briarwood Station is a below-grade station with two straight side platforms. The platform structure is cast-in-place concrete. The width of both platforms is approximately 11'-4". There are four staircases along each platform, all of which would not allow for the 32" width required for wheelchair movement with PSDs installed. Columns divide the path between the stairs and the platform edge. Column spacing along the length of the platform is approximately 15'-0" on center and column faces are typically 3'-2" to the edge of the platform. Currently, there is an ADA-compliant path of travel between columns and the platform edge (3'-2"). The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 23" would not allow for ADA compliant wheelchair movement.

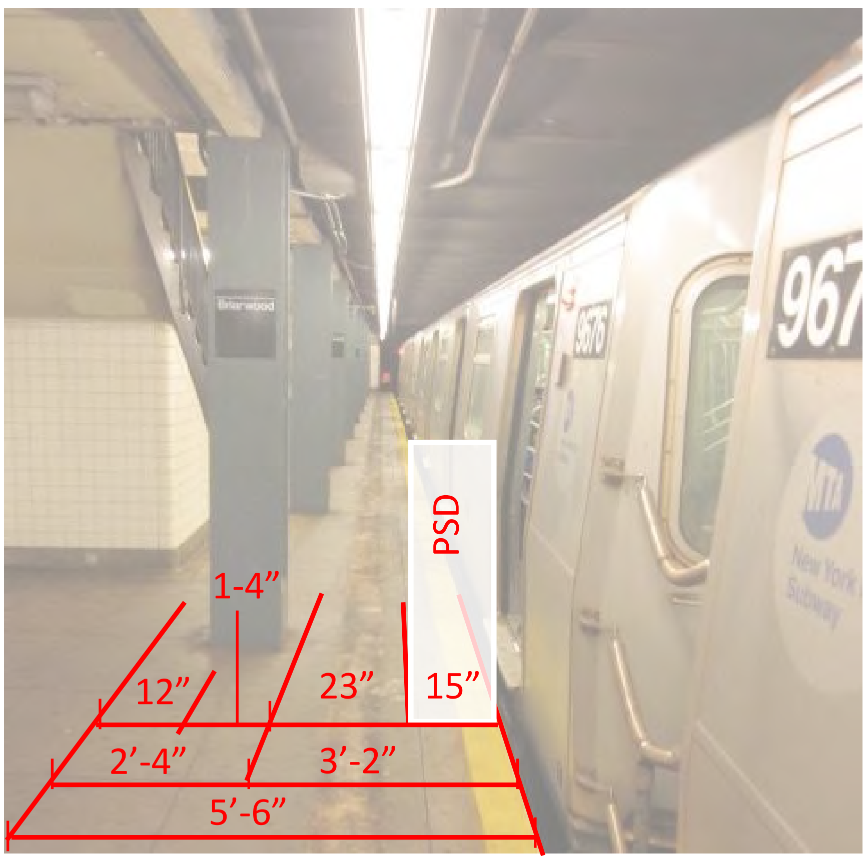

Figure 1 – Non-compliant ADA condition at stairs (typical)- Briarwood Station

1.6 MR-259 | Kew Gardens-Union Turnpike Station

Summary: *Kew Gardens-Union Turnpike Station (MR-259) is not feasible for both APGs and PSDs. The implementation of a platform edge barrier would result in non-compliant ADA conditions that would not allow for wheelchair movement along the length of the platform. At all stairs, the 32" minimum requirement for wheel chair circulation would not be met on one side of the platform (see figure 1). The remaining width would be 24".*

Description

Kew Gardens-Union Turnpike Station is a below-grade station consisting of two mildly curved center/island platforms. The cast-in-place concrete platforms are accessed via two mezzanines. There are six stairs and an elevator located on each platform. The platform is approximately 19'-0" wide. Column spacing along the length of the platform is approximately 15' on center and column faces are typically 3'-3" to the edge of the platform. Currently, at all stairs along the length of the platform, a wheel chair can move between the columns and the platform edge (3'-3"). All of the stairs are off center as shown in figure 1. Although there is adequate clear space on one side of the platform, the implementation of a platform edge barrier would not allow for ADA compliant wheelchair movement at the other side. Similarly, the elevators are shifted towards one side of the platform not allowing for 32" clearance (at one platform edge) for ADA compliant wheelchair movement. Both platform edges need to comply in order for the station to be ADA compliant for the implementation of a platform edge barrier.

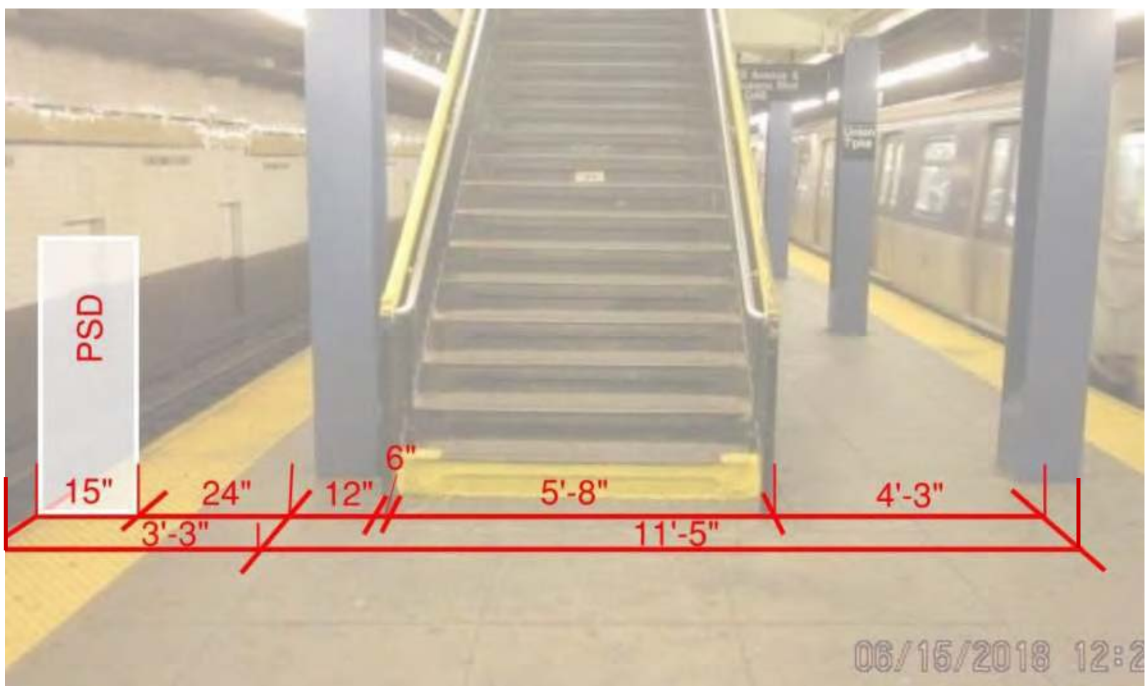

Figure 1 – Non-compliant condition on one side of the center/island platform- Kew Gardens-Union Turnpike

1.7 MR-260 | 75th Avenue Station

Summary: *75th Avenue Station (MR-260) is not feasible for both APGs and PSDs. The implementation of a platform edge barrier would result in non-compliant ADA conditions that would not allow for ADA compliant wheelchair movement along the length of the platform. At all stairs, the 32" minimum requirement for wheel chair circulation would not be met (see figure 1).*

Description

75th Avenue Station is a below-grade station consisting of two straight side platforms. The cast-in-place concrete platforms are accessed via a large mezzanine level. There are four stairs located in various locations along the length of each platform. The platforms are approximately 11'-4" wide. Column spacing along the length of the platform is approximately 15' on center and column faces are typically 3'-4" to the edge of the platform. Columns are 1'-10" away from stairs (not an ADA compliant path). Currently, at all stairs along the length of the platform, a wheel chair can move between the columns and the platform edge (3'-4"). In the implementation of a platform edge barrier, this clearance would be 25".

Figure 1 – Non-compliant condition at stairs (typical) - 75th Avenue

1.8 MR-221 | 21st Street- Queensbridge Station

***Summary:** 21st Street-Queensbridge Station (MR-221) is feasible for both APGs and PSDs. There are two signal boxes that would have to be relocated in the implementation of a platform edge barrier. Structural work would only be required in the implementation of APGs (see structural report; Appendix B) Electrical capacity at this station is adequate to support a APG/PSD system.*

Description

21st Street-Queensbridge Station is a below-grade station with two straight side platforms (see figure 1). The platform structure is cast-in-place concrete. Back-of-house elements are located at the mezzanine level and at the platform level away from passenger areas. The platforms are mostly column free. On both platforms, there are five 2' wide cylindrical columns which are 7'-6" away from the platform edge. Typically, the platform widths are approximately 11'-2". These columns are in a double height space that is open to the mezzanine level. On each platform, one train signal box hangs over the platform edge, with a vertical clearance of 7'-4". Ceiling heights vary throughout the station, ranging from 9'-2" to 20'-0".

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. The ceiling heights vary throughout the station (see figure 4). Train signal boxes on would need to be relocated in the implementation of full height PSDs (see figure 3).

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located on the Coney Island-bound platform adjacent to the elevators. The proposed room dimension is 7'-0" x 27'-0" (see figure 2).

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edge consists of a cast-in-place concrete cantilever that is approximately 1'-2" long and is approximately 5" thick. The platform also includes a 3" allowance for a floor finish, which was conservatively assumed to be a concrete topping slab for the purpose of assessing dead loads. The cantilever portion is reinforced with #4 rebar at 12" O.C. at the top of the slab. The station was designed in 1975, therefore it was assumed that the reinforcing rods have a yield strength of 40,000 psi (Grade 40) in the absence of additional information (Grade 60 rebar was in existence at the time, but not standard as it is today). The concrete has a compressive strength of 3000 psi, per the notes on the record drawings.

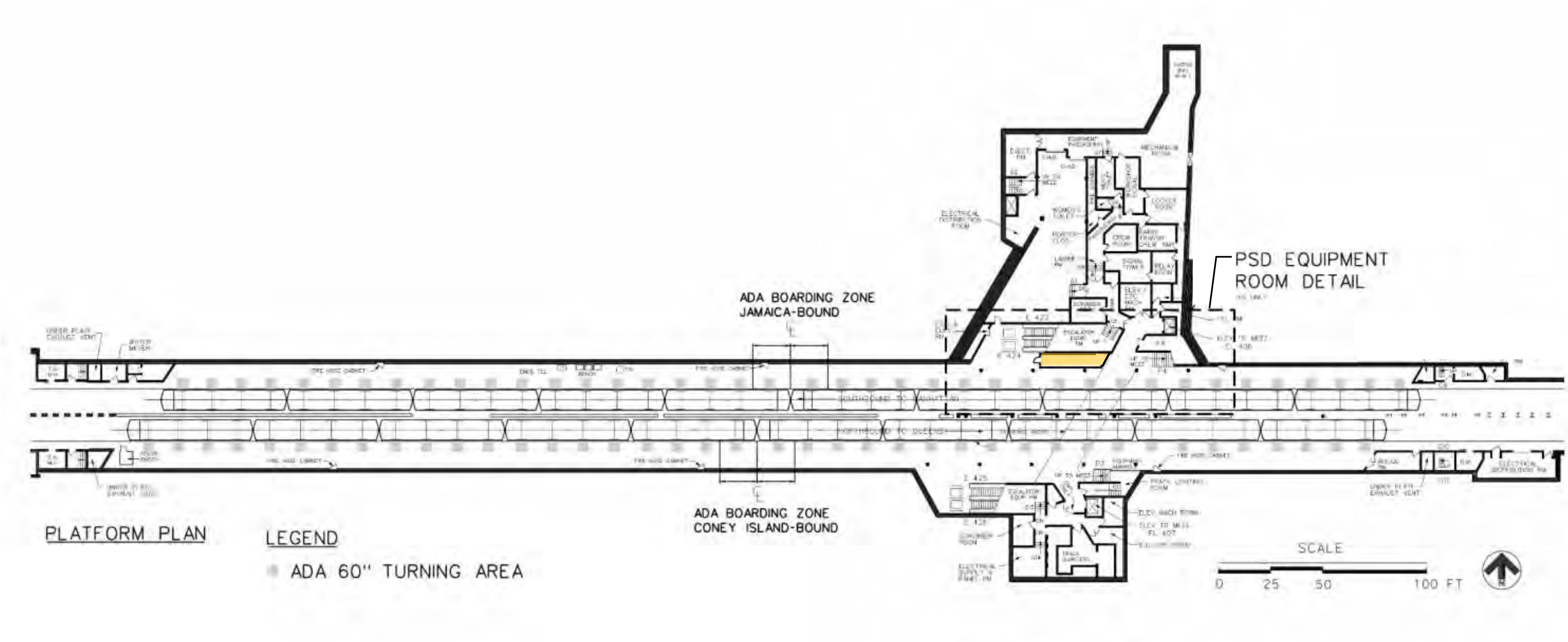

Figure 1 – Station Plan- 21st Street- Queensbridge Station

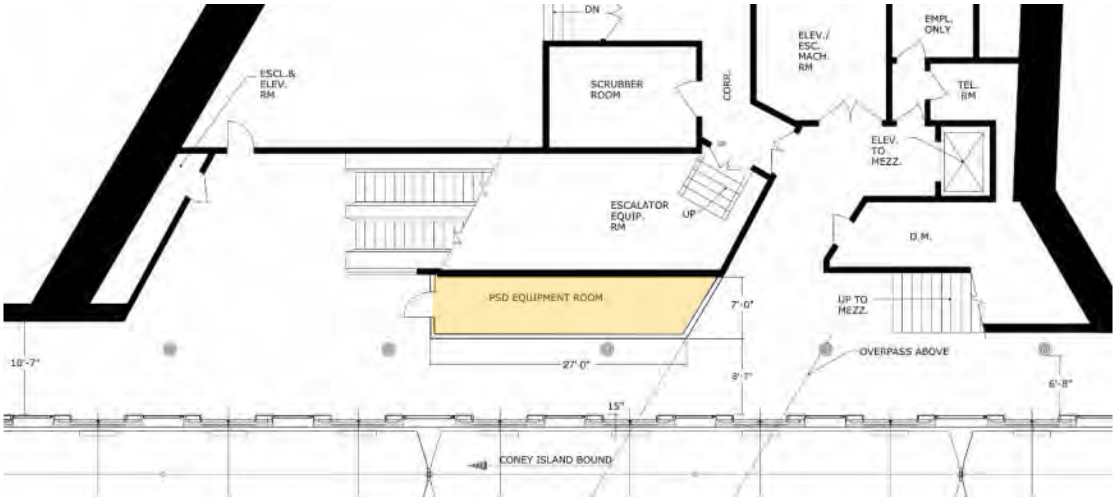

Figure 2 – PSD Equipment Room Detail – 21st Street- Queensbridge Station

Based upon the record drawings and the above assumptions, it was found that the cantilever edge has sufficient capacity to support a full height PSD system in its current condition. It cannot, however, support half height cantilevered APGs without rebuilding the platform edge to achieve a higher strength. This difference is due to the fact the APG system is fully supported at the cantilever edge and results in transfer of moment to the slab edge caused by crowd thrust and wind loading (piston effect), in addition to the weight of the system itself. The PSD system results in a moment on the slab edge due to its weight only. In both cases, self-weight of the slab edge and live load on the platform have been accounted for. The wind load and crowd thrust also result in direct tension on the slab edge, for which the slab has sufficient capacity in either case.

The 2012 NYCT conditions survey gave the platform edges an average rating of 2.5. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

Platform obstructions within 5' of edge:

None

Lighting:

Existing lighting: Along the majority of the platform, linear florescent lighting is perpendicular to the platform edge and located between structural members. In the double height area, there are recessed florescent fixtures and can lighting. It is unlikely that the existing lighting would need to be modified at this station.

Power:

We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station. MRN 221 has adequate capacity to support the implementation of a APG/PSD system.

Station
Power Capacity Analysis

NYCT Station MR Number	221
Station Name	21st Street Queensbridge
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	404.0
Apparent Power (kVA)	505.0
Station Peak Demand Load, Max Current, (A)	1402.8
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	1597
Station Service Power Capacity, (Main SB or SG Rating), (A)	3000
Service Spare Capacity, (A)	1403
Is Electrical Service Adequate?	Yes
Notes	Station does not have 1 line diagram. This analysis is based on one meter reading only.

Table 1. MRN 221 Power Capacity Analysis

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.4M to install APGs and $39.8M to install PSDs (See Appendix E)

Figure 3 – Typical platform view with signal box- 21st Street- Queensbridge Station

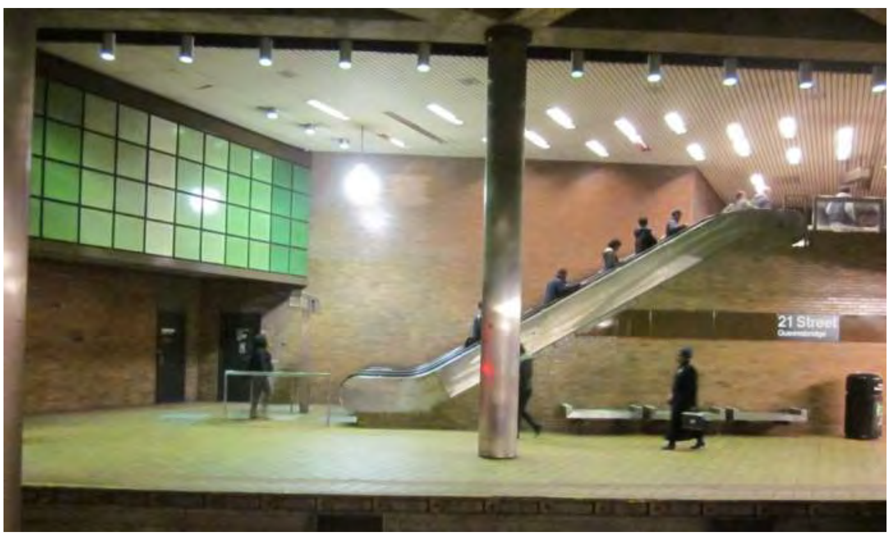

Figure 4 – View of double-height area - 21st Street- Queensbridge Station

1.9 MR-222 | Roosevelt Island Station

Summary: *Roosevelt Island Station (MR-222) is feasible for both APGs and PSDs. There are a variety of conditions in this station including curved or straight walls and ceilings, varying ceiling heights, and different lighting supports. Structural work would only be required in the implementation of APGs (see structural report; Appendix B). Electrical capacity at this station is adequate to support a APG/PSD system.*

Description

Roosevelt Island Station is a below-grade station with two straight side platforms. The platform structure is cast-in-place concrete. Back-of-house elements are located at the end of the platforms and at the mezzanine level. The platforms are column free. Typically, the platform widths are approximately 12'-0". There are a variety of platform conditions, in which the platform is a combination of curved and/or straight walls and ceilings. Ceiling heights vary from 7'-10" to 12'-10". Figures 3 and 4 represent typical platform wall and ceiling combinations as well as various lighting conditions.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the north-end of the Jamaica-bound platform. The proposed room dimension is 7'-0" x 27'-0" (see figure 2).

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edge consists of a cast-in-place concrete cantilever that is approximately 1'-2" long and is approximately 5" thick. The platform also includes a 3" allowance for a floor finish, which was conservatively assumed to be a concrete topping slab for the purpose of assessing dead loads. The cantilever portion is reinforced with #4 rebar at 12" O.C. at the top of the slab. The station was designed in 1975, therefore it was assumed that the reinforcing rods have a yield strength of 40,000 psi (Grade 40) in the absence of additional information (Grade 60 rebar was in existence at the time, but not standard as it is today). The concrete has a compressive strength of 3000 psi, per the notes on the record drawings.

Based upon the record drawings and the above assumptions, it was found that the cantilever edge has sufficient capacity to support a full height PSD system in its current condition. It cannot, however, support

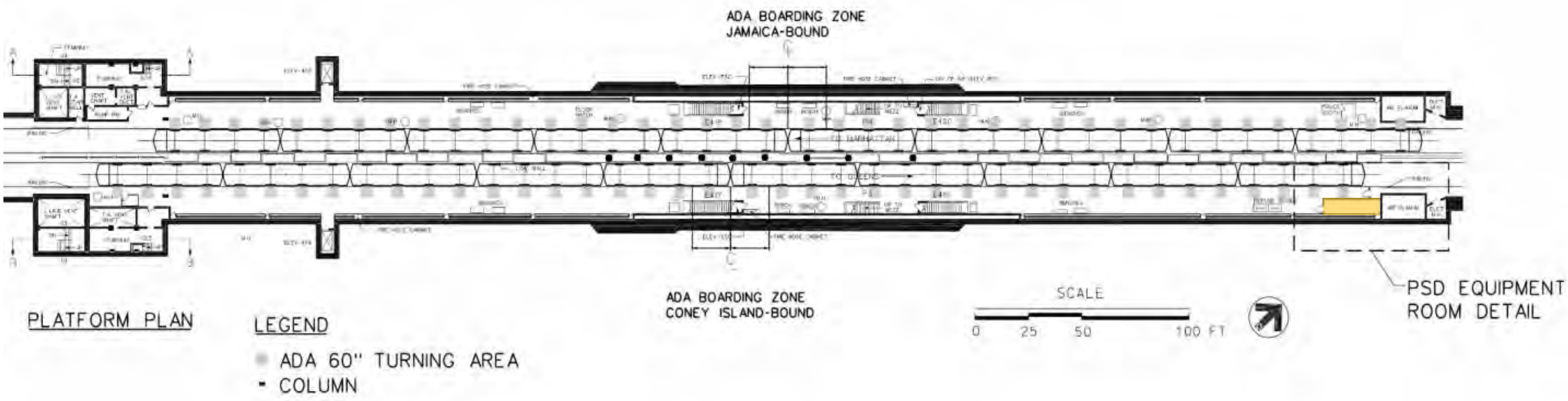

Figure 1 – Station Plan- Roosevelt Island Station

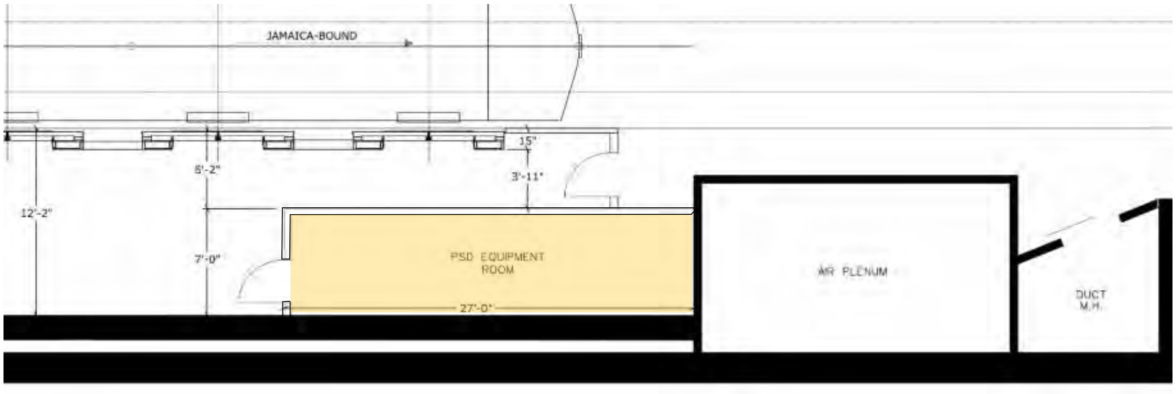

Figure 2 – PSD Equipment Room Detail – Roosevelt Island Station

half height cantilevered APGs without rebuilding the platform edge to achieve a higher strength. This difference is due to the fact the APG system is fully supported at the cantilever edge and results in transfer of moment to the slab edge caused by crowd thrust and wind loading (piston effect), in addition to the weight of the system itself. The PSD system results in a moment on the slab edge due to its weight only. In both cases, self-weight of the slab edge and live load on the platform have been accounted for. The wind load and crowd thrust also result in direct tension on the slab edge, for which the slab has sufficient capacity in either case.

The 2012 NYCT conditions survey gave the platform edges an average rating of 3.25. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

Platform obstructions within 5' of edge:

None.

Lighting:

Existing lighting: Linear fluorescent lighting is surrounded by a continuous 1'-6" tube fixture. The fixtures are 20" from the edge of the platform and have a vertical clearance of 7'-10". As the ceiling heights vary, the lighting is either suspended with angular supports some of which extend over the platform edge (figure 3) or mounted on the ceiling (figure 4). There is also cove lighting along the top of the back wall of the platforms.

Power:

We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station. MRN 222 has adequate capacity to support the implementation of a APG/PSD system.

Station
Power Capacity Analysis

NYCT Station MR Number	222
Station Name	Roosevelt Island
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	555.8
Apparent Power (kVA)	694.8
Station Peak Demand Load, Max Current, (A)	1930.0
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	2125
Station Service Power Capacity, (Main SB or SG Rating), (A)	5500
Service Spare Capacity, (A)	3375
Is Electrical Service Adequate?	Yes
Notes	Station has 2500 A service @ 460 Volt (not 208 V) with max demand of 555.8 KW. We have converted ratings values to 208 V. Station does not have 1 line diagram.

Table 1. MRN 222 Power Capacity Analysis

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.5M to install APGs and $40.8M to install PSDs (See Appendix E)

Figure 3 – Typical platform view featuring curved walls and ceilings- Roosevelt Island Station

Figure 4 – Platform view featuring low planar ceiling with cured and straight walls- Roosevelt Island Station

1.10 MR-223 | Lexington Avenue-63rd Street Station

Summary: *Lexington Avenue-63rd Street Station (MR-223) is feasible for both APGs and PSDs. The recent renovation work at this station conceals the structure at the platform edge. Modifications to this renovation work may be needed to accommodate a PSD system. Structural work would only be required in the implementation of APGs (see structural report; Appendix B). It is assumed that power is adequate.*

Description

Lexington Avenue- 63rd Street Station is a below-grade station with two straight center/island platforms (see figure 1). The platforms are stacked; the upper level provides Coney Island-bound service, while the lower level provides Jamaica-bound service. These platforms also provides Q-line service, similarly with the directions of travel on separate platform levels. This station was renovated in the Second Avenue Subway expansion (opened January 2017). Four elevators are located in a vestibule at the east-end of the station. The platform structure is cast-in-place concrete. Back-of-house elements are located at the end of the platforms and at the mezzanine levels. At the middle of both platforms there are six columns in two rows spaced 8'-0" apart with column faces 4'-6" from the edge of the platform. In addition to these columns, the lower level has a row of columns centered on the platform width spaced 15'-0" on center. At the upper level, there are ceiling mounted metal panels that are angled and extend beyond the platform edge (see figure 3). At the lower level, there are horizontal metal mesh panels covering the beams at and beyond the platform edge (see figure 4).

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Due to the treatment of the ceilings at and beyond the platform edge, modification of metal panels may be necessary to create the supporting structure of a full height system.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

This station will need two equipment rooms as there are four platform edges. For the two F-line platform edges, one room can be located in the middle of the lower level platform between the existing columns. The proposed room dimension is 12'-0" x 16'-0" (see figure 2).

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'F' Line Stations
(Lexington Avenue-63rd Street Station)

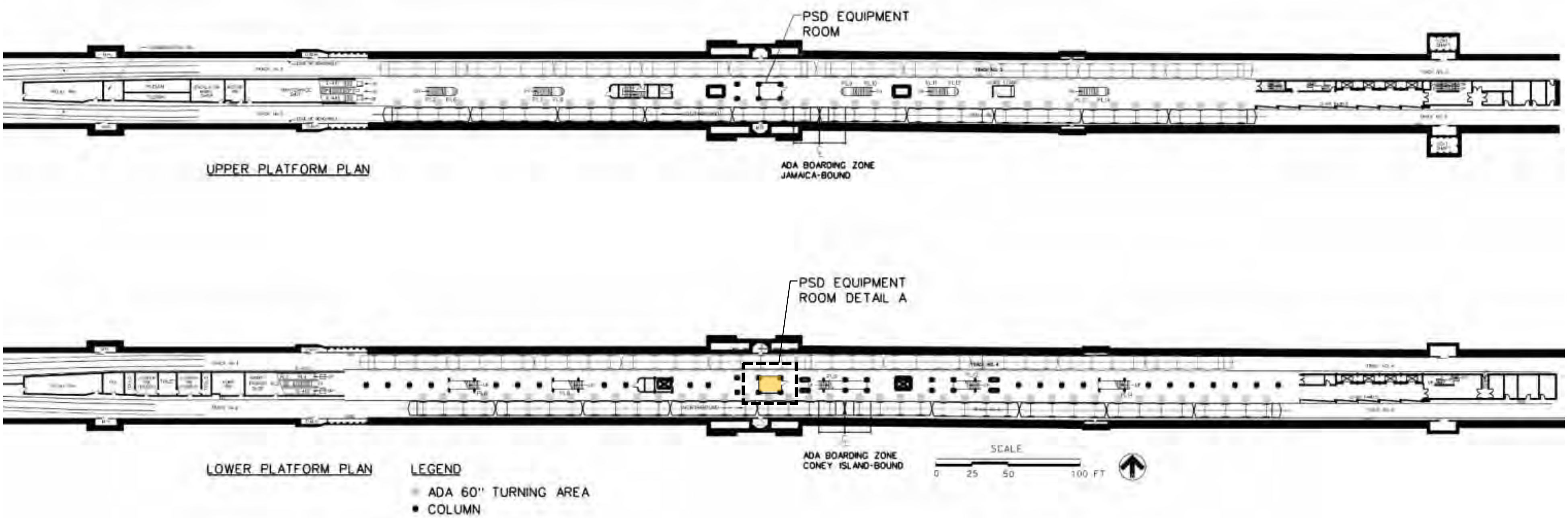

Figure 1 – Station Plan- Lexington Ave.-63rd St. Station

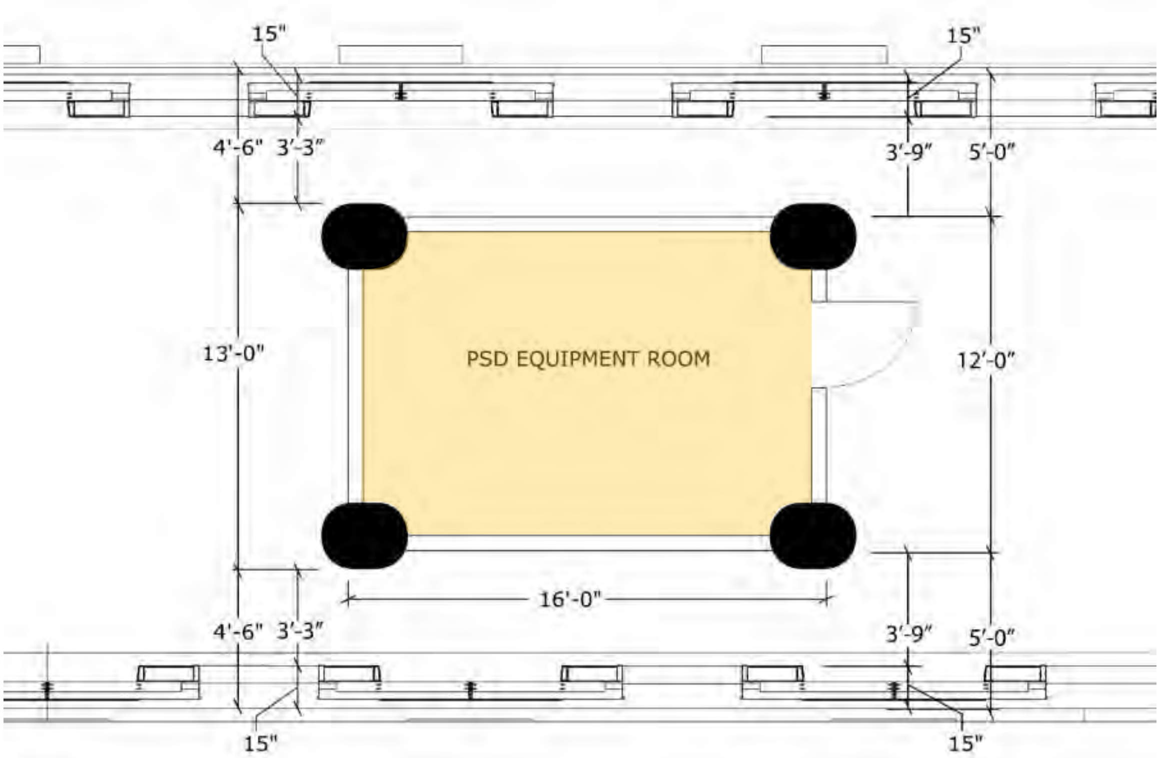

Figure 2 – PSD Equipment Room Detail – Lexington Ave.-63rd St. Station

Platform Edge Condition

The platform edge consists of a cast-in-place concrete cantilever that is approximately 1'-2" long and is approximately 5" thick. The platform also includes a 3" allowance for a floor finish, which was conservatively assumed to be a concrete topping slab for the purpose of assessing dead loads. The cantilever portion is reinforced with #4 rebar at 12" O.C. at the top of the slab. The station was designed in 1975, therefore it was assumed that the reinforcing rods have a yield strength of 40,000 psi (Grade 40) in the absence of additional information (Grade 60 rebar was in existence at the time, but not standard as it is today). The concrete has a compressive strength of 3000 psi, per the notes on the record drawings.

Based upon the record drawings and the above assumptions, it was found that the cantilever edge has sufficient capacity to support a full height PSD system in its current condition. It cannot, however, support half height cantilevered APGs without rebuilding the platform edge to achieve a higher strength. This difference is due to the fact the APG system is fully supported at the cantilever edge and results in transfer of moment to the slab edge caused by crowd thrust and wind loading (piston effect), in addition to the weight of the system itself. The PSD system results in a moment on the slab edge due to its weight only. In both cases, self-weight of the slab edge and live load on the platform have been accounted for. The wind load and crowd thrust also result in direct tension on the slab edge, for which the slab has sufficient capacity in either case.

As this station was recently renovated, the platform edge score from the 2012 NYCT conditions survey is not a reflection of current conditions.

Platform obstructions within 5' of edge:

Coney Island-bound: There are three columns that are 4'-7" away from the platform edge.

Jamaica-bound: There are three columns that are 4'-7" away from the platform edge.

Lighting:

Existing lighting: Lighting comprises of 1'-6" fluorescent tubes recessed above removable ceiling panels, and encased fluorescent tubes installed approximately 60" away from the platform edge

Power:

This information was not ascertainable at the time of the survey. However, we do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.6M to install APGs and $39.3M to install PSDs (See Appendix E)

Figure 3 – Platform edge condition on the lower level (Coney Island-bound)- Lexington Ave.-63rd St. Station

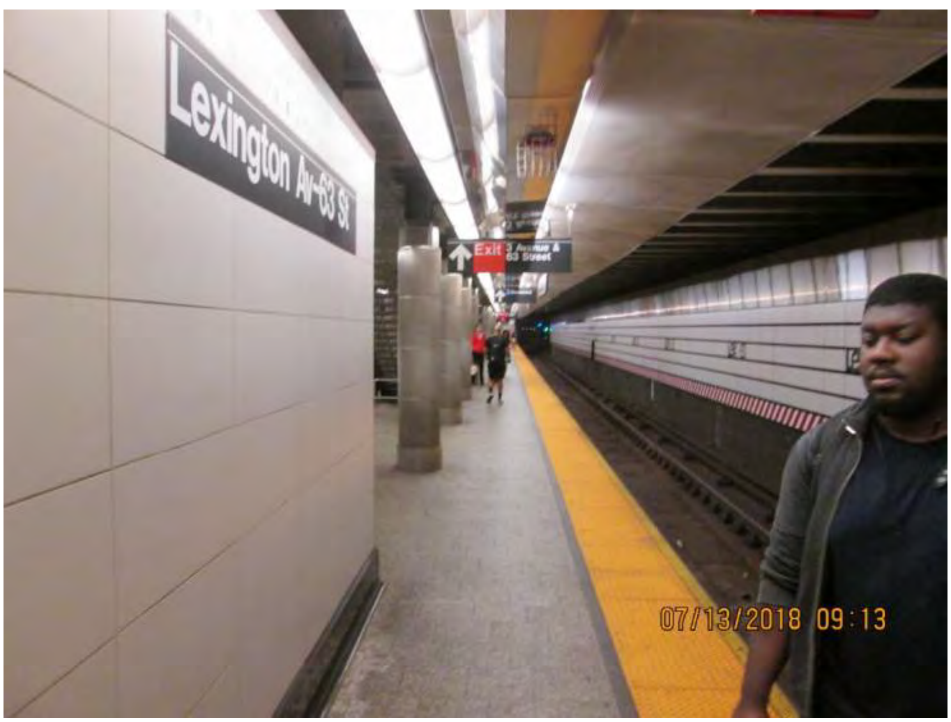

Figure 4 –Platform edge condition on the lower level (Jamaica-bound)- Lexington Ave.-63rd St. Station

1.11 MR-224 | 57th Street Station

***Summary:** 57th Street Station (MR-224) is not feasible for both APGs and PSDs. The implementation of a platform edge barrier would result in non-compliant ADA conditions that would not allow for ADA compliant wheelchair movement along the length of the platform. At some stairs, the 32" minimum requirement for wheel chair circulation would not be met on one side of the platform. See figure 1 for the typical non-compliant condition occurring on one side of the platform.*

Description

57th Street Station is a below-grade station consisting of one straight center/island platform. The cast-in-place concrete platforms are accessed via a mezzanine. There are six stairs on the platform. Four of these stairs are shifted towards one side of the platform adjacent to columns. The platform is approximately 23'-0" wide. Column spacing along the length of the platform is approximately 15' on center and column faces are typically 3'-4" to the edge of the platform. Currently, at all stairs along the length of the platform, a wheel chair can move between the columns and the platform edge (3'-4"). Four of the six stairs are off center as shown in figure 1. Although there is adequate clear space on one side of the platform, the implementation of a platform edge barrier would not allow for ADA compliant wheelchair movement at the other side. Both platform edges need to comply in order for the station to be deemed feasible for the implementation of a platform edge barrier.

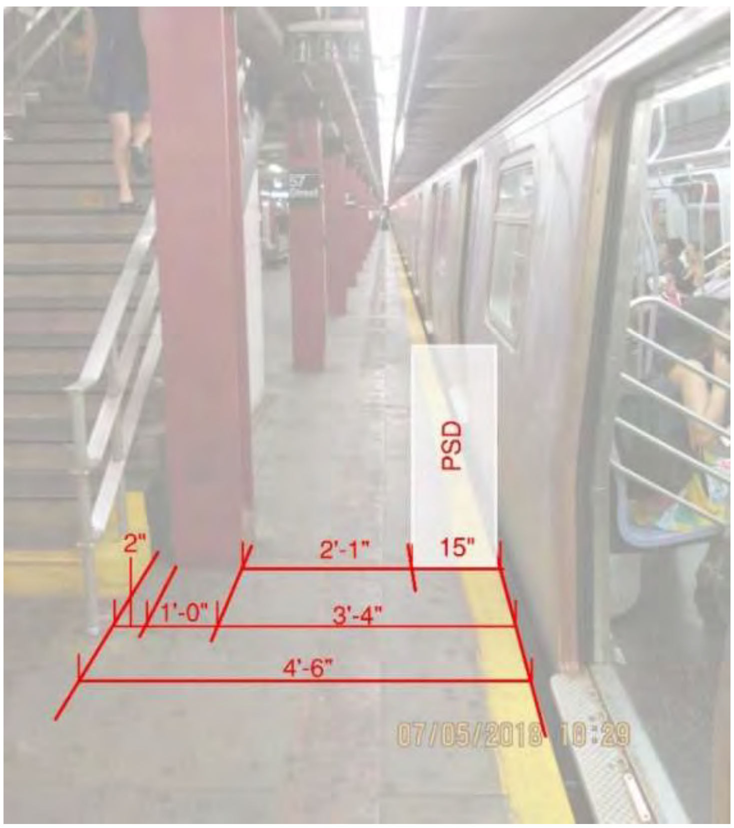

Figure 1 – Non-compliant ADA condition on one side of the center/island platform- 57th Street

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1.12 MR-232 | 2nd Avenue Station

Summary: *2nd Avenue (MR-232) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. There a flue vents located at the center of both platforms, flanked by columns on both sides of the platform. The ADA constraints occur due to columns surrounding the vent flues on both center/island platforms. Currently, the distance between the column and the edge of the platform is 36" and the spacing between the column and the wall of the vent flue is 18" on one side and 30" on the other. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA compliant wheelchair movement would not be met at vent flues as the remaining width would be 21" (see figure 1).*

Description

2nd Avenue Station is a below-grade station with two straight center/island platforms. The platform structure is cast-in-place concrete. The width of both platforms is approximately 19'-4". A vent is centered on both the Jamaica-bound and Coney Island-bound platforms. Currently, there is an ADA compliant path of travel between the column face and the platform edge (3'-0"). The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 21" would not allow for ADA compliant wheelchair movement.

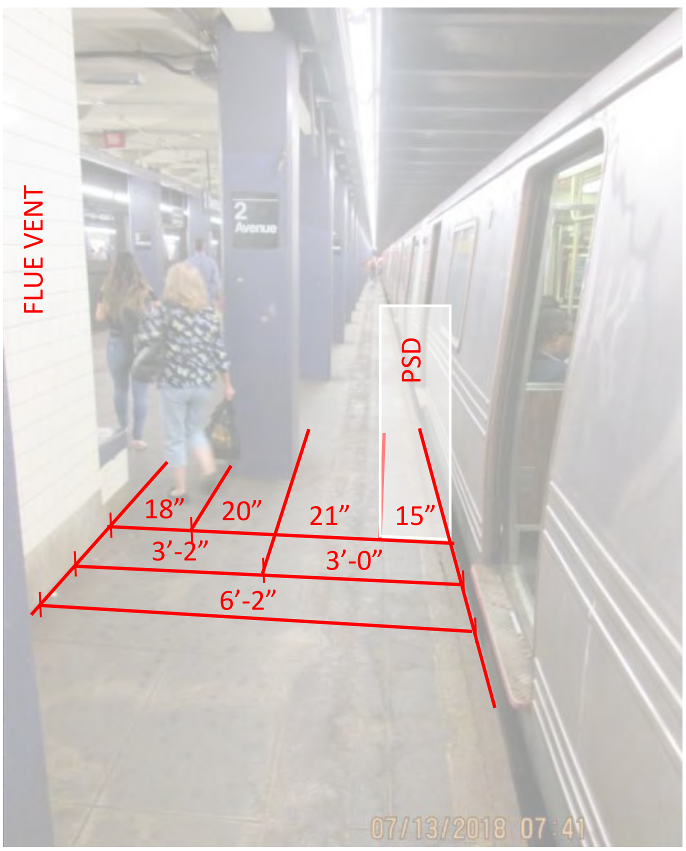

Figure 1 – Non-compliant ADA condition at flue vent- 2nd Avenue Statio

1.13 MR-233 | Delancey Street Station

Summary: *Delancey Street Station (MR-233) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, there are two locations along the Jamaica-bound platform that would result in non-compliant conditions. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA compliant wheelchair movement would not be met due to the location of an existing escalator and an escalator pit room. In the implementation of a platform edge barrier, the widest remaining widths in either situation would be 30" and 26" respectively (see figures 1 and 2).*

Description

Delancey Street Station is a below-grade station with straight side platforms. The platform structure is cast-in-place concrete. The width of both side platforms is approximately 12'-8". Columns are spaced 15'-0" on center with faces 3'-0" from the platform edge. Currently, there is an ADA-compliant path of travel between columns and the platform edge (3'-0"). The implementation of a platform edge barrier would reduce this width below the required minimum of 32" at two specific locations on the Jamaica-bound platform (see figures 1 and 2). Remaining widths would not allow for ADA compliant wheelchair movement.

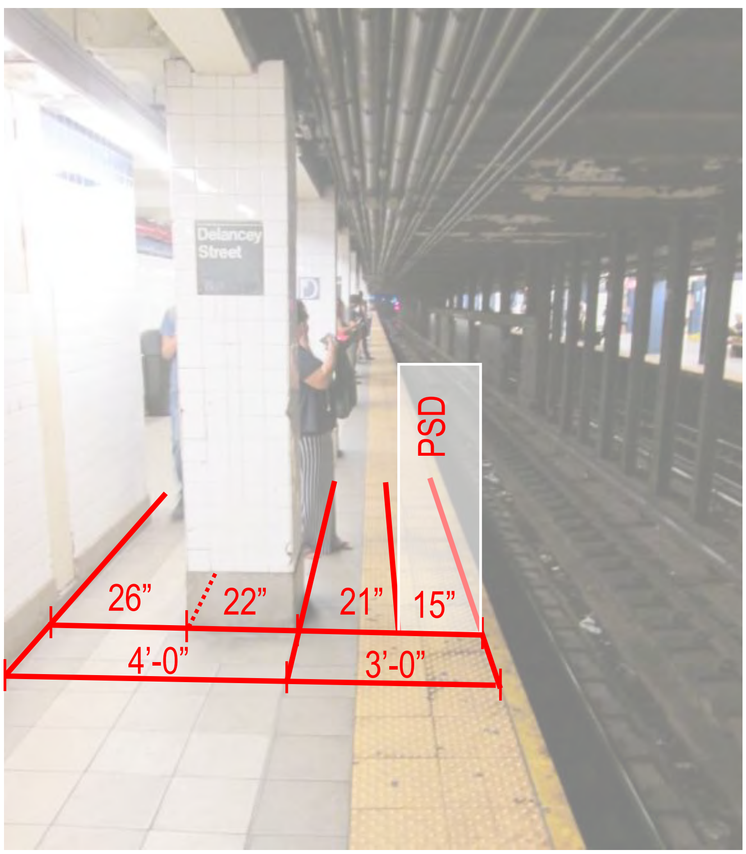

Figure 1 – Non-compliant ADA condition at escalator 328- Delancey Street Station

1.14 MR-234 | East Broadway Station

***Summary:** East Broadway Station (MR-234) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA compliant wheelchair movement would not be met at five of the seven stairs/escalators. The remaining width would be 25" (see figure 1). The stairs/escalators at this station are typically off-center, located closer to the local track platform edge. Currently, columns divide the 6'-0" width between the platform edge and the stairs/escalators.*

Description

East Broadway Station is a below grade station with a straight center/island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 17'-6". Columns are spaced 15'-0" on center with column faces 3'-4" from the platform edge. Passengers requiring an ADA compliant path can currently move in the 3'-4" space between the stairs and platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 25" would not allow for ADA compliant wheelchair movement.

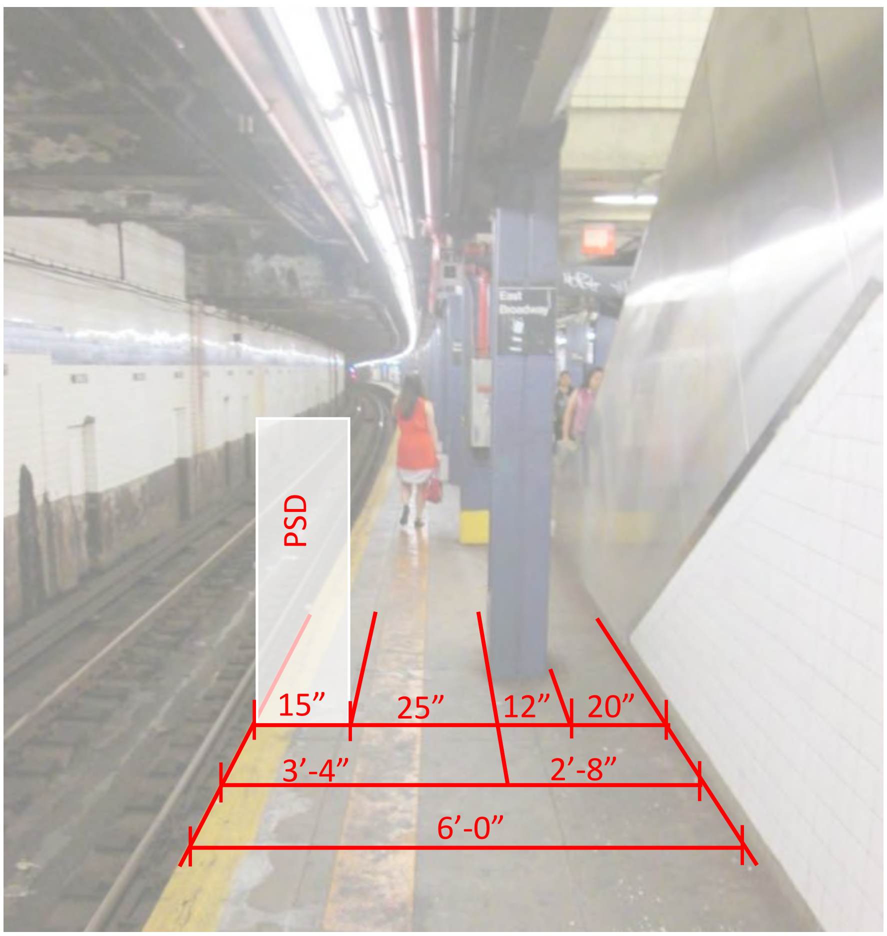

Figure 1 – Non-compliant ADA condition at stairs/escalator (typical)- East Broadway Station

1.15 MR-235 | York Street Station

Summary: *York Street Station (MR-235) is feasible for both APGs and PSDs. There is area at the south-end of the platform where a PSD equipment room can be located. Platform structural work will be required to support the requirements of an APG or PSD system (see structural report; Appendix B). It is assumed that existing power is adequate.*

Description

York Street Station is a below-grade station with a straight center/island platform (see figure 1). The platform has one stair at the north-end of the platform. The platform structure is cast-in-place concrete. Back-of-house elements are situated in the mezzanine, which is connected to the station platform through a ramp passageway. The platform width is approximately 18'-8" wide. There are two rows of columns that are spaced 15'-0" on center, with column faces 2'-8" from the platform edge. The distance between the two rows of columns is typically 11'-0". For an overall station plan, see figure 1. See figure 3 for a typical platform view.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, entrapment prevention sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be CCTV cameras over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Wall-mounted and hung conduits below the platform edge would need to be relocated to accommodate the requirements of the APG system.

Equipment Room

One room can be accommodated at the south-end of the platform. The proposed room dimension is 12'-0" x 16'-0" (see figure 2).

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

Structural work should be required for the installation of an APG or PSD system due to the current platform edge condition rating. The 2012 NYCT conditions survey gave the platform edges an average rating of 2.75. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair

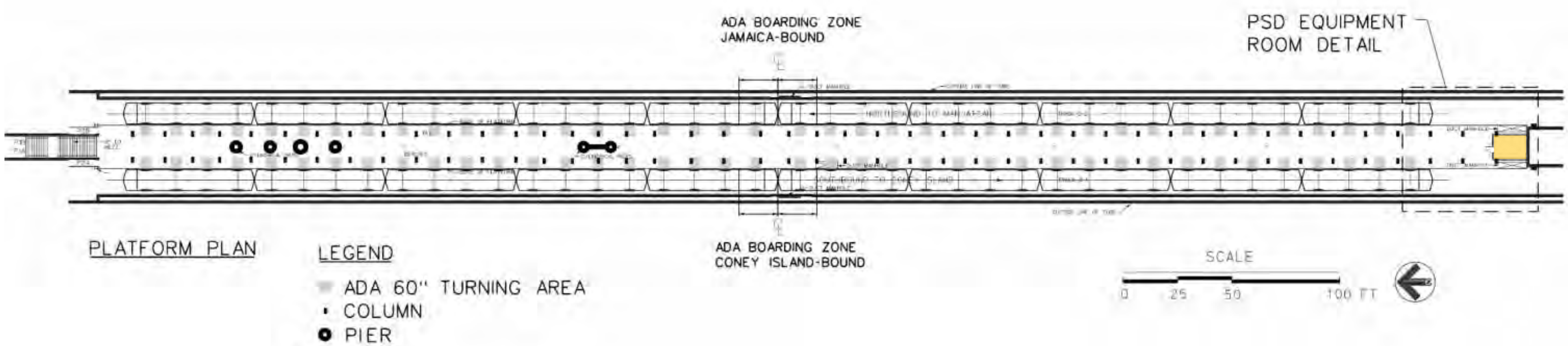

Figure 1 – Station Plan-York Street Station

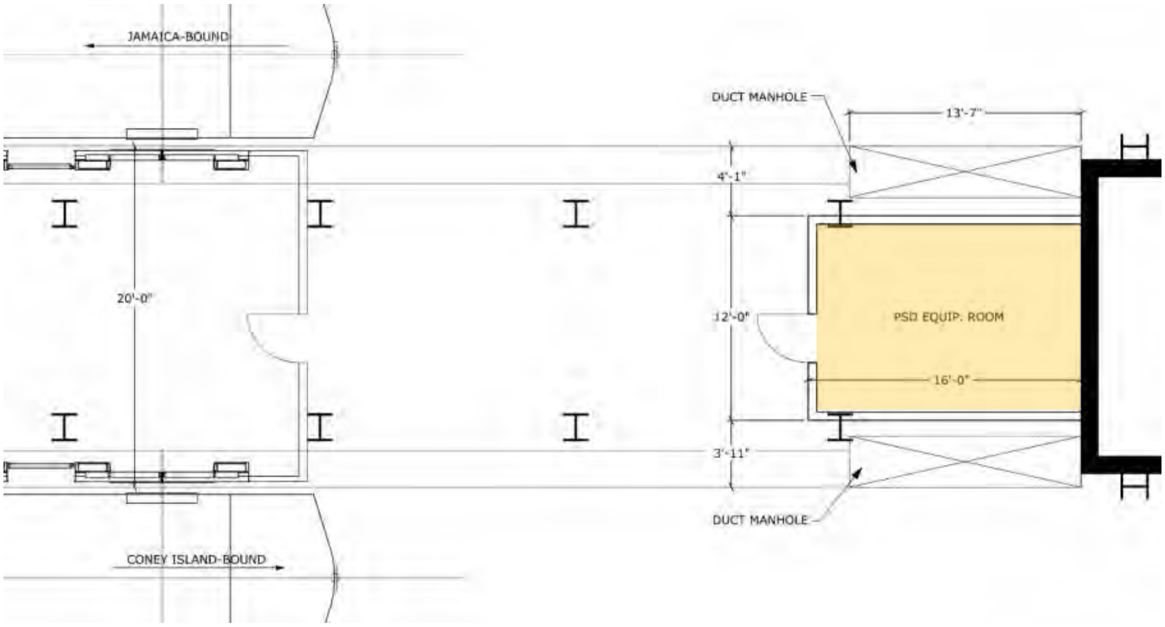

Figure 2 – PSD Equipment Room Detail – York Street Station

Platform obstructions within 5' of edge:

All columns are 32" from the platform edge. Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A.

Lighting:

Existing lighting: Linear fluorescent; approximately 1' from the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This information was not ascertainable at the time of the survey. However, we do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Historic Restrictions:

None.

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.5M to install APGs and $41.2M to install PSDs (See Appendix E).

Figure 3– Typical platform view- York Street Stati

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1.16 MR-174 | Jay Street-MetroTech Station

Summary: *Jay Street-MetroTech Station (MR-174) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. The platforms serving the 'F' line also serve the 'A' and 'C' lines. In the implementation of a platform edge barrier, the 32" minimum pinch width requirement for ADA compliant wheelchair movement would not be met at several stairs on both platforms. These stairs are not centered on the width of the platform, but are closer to the 'A' and 'C' track side of the platform. In these conditions, the remaining width would be 27" (see figure 1). Although the minimum required circulation width is met on one side of the platform, compliance is required on both sides of the platform in order to be feasible.*

Description

Jay Street-MetroTech Station is a below-grade station with two straight center/island platforms. The platform structure is cast-in-place concrete and serves the 'F', 'A', and 'C' lines. The width of the platform is approximately 24'-8". Columns are spaced 15'-0" on center with column faces 3'-6" away from the platform edge. The columns on the northbound (Jamaica-179th Street) platform are exposed, while on the southbound (Coney Island-Stillwell Avenue) platform have a tile surround. On both platforms, column faces are 3'-6" from the platform edge. Currently, there is an ADA-compliant path of travel between columns and the platform edge (3'-6"). The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 27" would not allow for ADA compliant wheelchair movement.

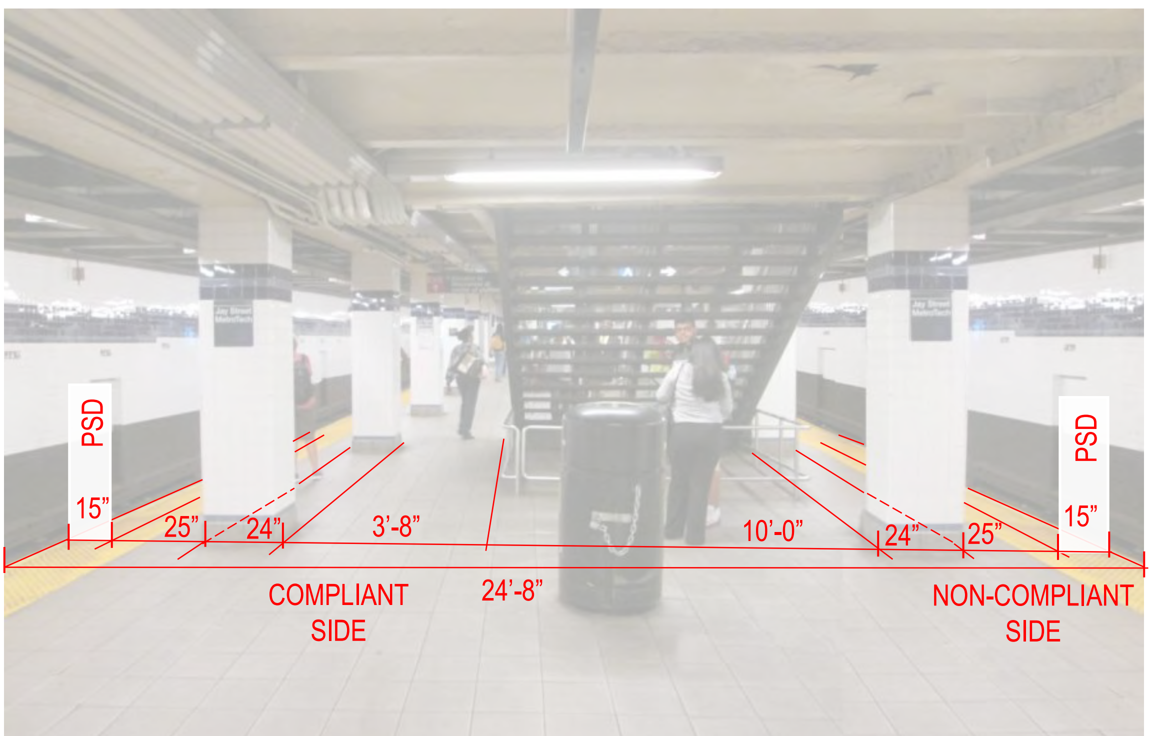

Figure 1 – Non-compliant ADA condition on one side of platform (southbound)- Jay Street- MetroTech Station

1.17 MR-244 | Ditmas Avenue Station

Summary: *Ditmas Avenue Station (MR-244) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2). Additionally, the implementation of a platform edge barrier would result in non-compliant ADA conditions. At the stairs on the north-end of both platforms, the 32" required width would not be met (see figure 1).*

Description:

Ditmas Avenue Station is an elevated station consisting of two side platforms. Both platforms are 11'-4" wide. The platform is straight with a row of a columns against the back wall of the platform. The canopy covers the entirety of the platform length. See figure 1 for a general platform view of Ditmas Avenue Station. The stair at the north-end of the platform is 3'-6" away from the platform edge. In the implementation of a platform edge barrier, the remaining width at the stair would be insufficient for wheelchair movement.

Figure 1– Non-compliant ADA Condition – Ditmas Avenue Station

Figure 2– Precast T-Beam platform – Ditmas Avenue Station

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1.18 MR-245 | 18th Avenue Station

Summary: *18th Avenue Station (MR-245) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2). Additionally, the implementation of a platform edge barrier would result in non-compliant ADA conditions. At the stairs on the north-end of both platforms, the 32" required width would not be met (see figure 1).*

Description:

18th Avenue Station is an elevated station consisting of two center/island platforms, one of which is currently not in service. The accessible platform is 16'-4" wide. The platform is straight with a row of columns centered on the width of the platform. The canopy covers the entirety of the platform length. The stair at the north-end of the platform is 3'-6" away from the platform edge. In the implementation of a platform edge barrier, the remaining width at the stair would be insufficient for wheelchair movement.

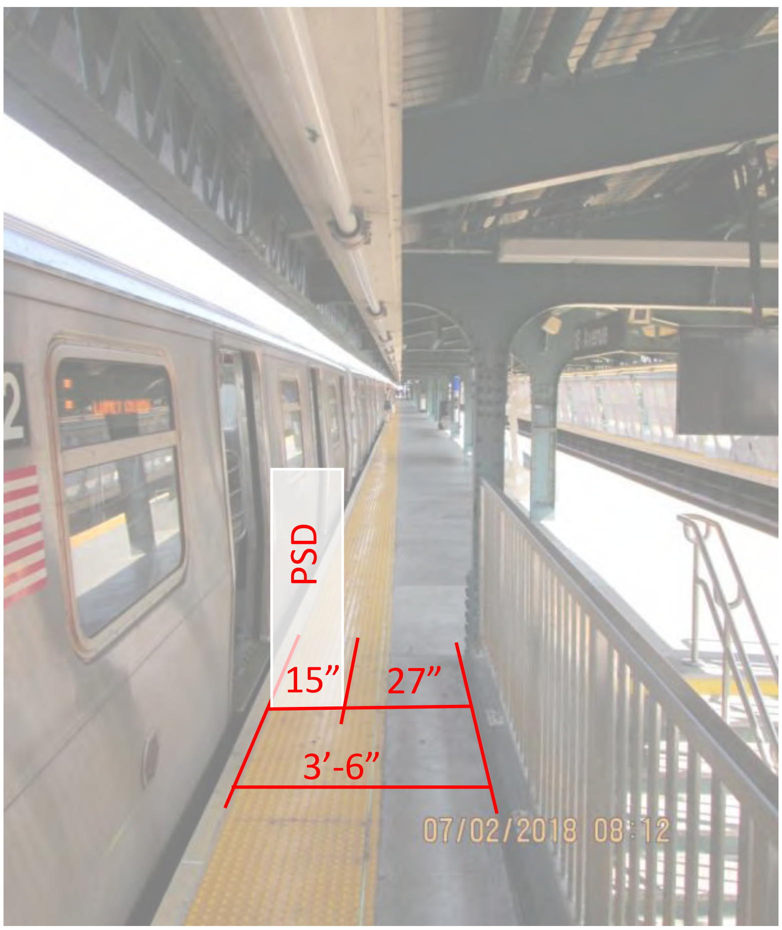

Figure 1– Non-compliant ADA condition – 18th Avenue Station

Figure 2– Precast T-Beam platform – 18th Avenue Station

1.19 MR-246 | Avenue I Station

Summary: *Avenue I Station (MR-246) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2). Additionally, the implementation of a platform edge barrier would result in non-compliant ADA conditions. At the stairs on the south-end of both platforms, the 32" required width would not be met as the remaining width would be 17" (see figure 1).*

Description:

Avenue I Station is an elevated station consisting of two side platforms, one of which is currently not in service. Each platform is 11'-4" wide. The platform is straight with a row of a columns against the back wall of the platform, which supports the station canopy. The canopy covers the entirety of the platform length. The stair at the south-end of the platform is 32" away from the platform edge. In the implementation of a platform edge barrier, the remaining width adjacent to the stair would be insufficient for wheelchair movement.

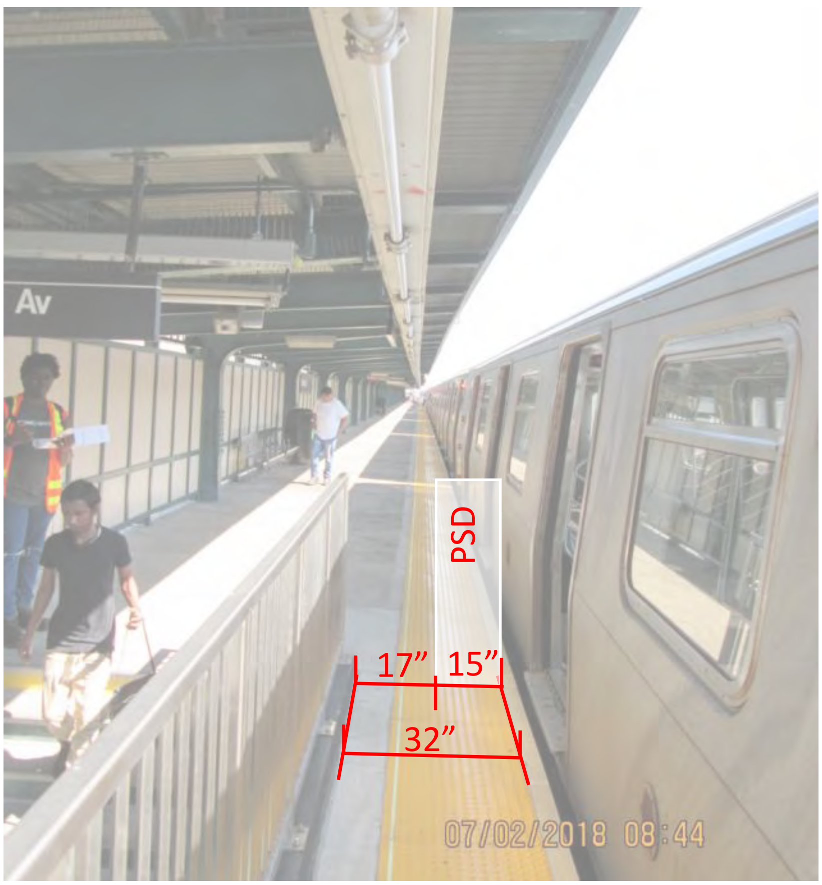

Figure 1– General Platform Condition – Avenue I Station

Figure 2– Precast T-Beam platform – Avenue I Station

1.20 MR-247 | Bay Parkway Station

Summary: *Bay Parkway Station (MR-247) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2).*

Description:

Bay Parkway Station is an elevated station consisting of two side platforms, one of which is currently not in service. Each platform is 11'-4" wide. The platform is straight with a row of a columns flush with the wall of the platform, which supports the station canopy. The canopy covers approximately half of the platform, which is found to be inadequate cover for a full height PSD system. See figure 1 for a general platform view of Bay Parkway Station.

Figure 1– General Platform Condition – Bay Parkway Station

Figure 2– Precast T-Beam platform – Bay Parkway Station

1.21 MR-248 | Avenue N Station

Summary: *Avenue N Station (MR-248) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2). Additionally, the implementation of a platform edge barrier would result in non-compliant ADA conditions. At the stairs on the north-end of both platforms, the 32" required width would not be met (see figure 1).*

Description:

Avenue N Station is an at-grade station consisting of two side platforms, one of which is currently not in service. Each platform is 11'-4" wide. The platform is straight with a row of a columns flush with the wall of the platform, which supports the station canopy. The canopy covers the entirety of the platform length. The stair at the south-end of the platform is 28" away from the platform edge. This width is currently not ADA compliant and the implementation of a platform edge barrier would further exacerbate this condition.

Figure 1– General Platform Condition – Avenue N Station

Figure 2– Precast T-Beam platform – Avenue N Station

1.22 MR-249 | Avenue P Station

Summary: *Avenue P Station (MR-249) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2). Additionally, the implementation of a platform edge barrier would result in non-compliant ADA conditions. The stairs are located at the center of the platform and are 3'-8" (44") away from the platform edge. In the implementation of a platform edge barrier, the 32" required width would not be met as the remaining width would be approximately 29" (see figure 1).*

Description:

Avenue P Station is an at-grade station consisting of two side platforms, one of which is currently not in service. Each platform is 11'-4" wide. The platform is straight with a row of a columns against the wall of the platform, which supports the station canopy. The canopy covers the entirety of the platform length. The centrally located stairs are 3'-8" (44") away from the platform edge. The implementation of a platform edge barrier would not allow for ADA compliant wheelchair movement.

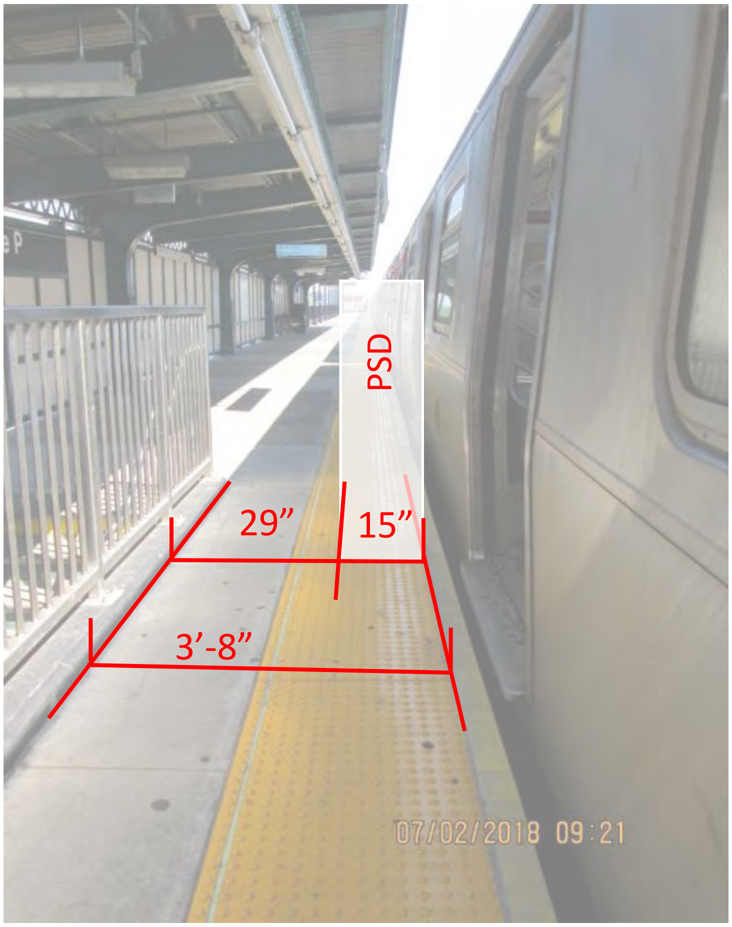

Figure 1– Non-compliant ADA condition at stairs – Avenue P Station

Figure 2– Precast T-Beam platform – Avenue P Station

1.23 Mr-250 | Kings Highway Station

Summary: *Kings Highway Station (MR-250) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2).*

Description:

Kings Highway Station is an at-grade station consisting of two center/island platforms, one of which is currently not in service. Each center platform is 16'-4" wide. The platform has a singular row of columns supporting a canopy with a spacing of 7'-8" from the column to the edge of the platform. The canopy covers the entirety of the platform length. See figure 1 for a general platform view of Kings Highway Station.

Figure 1– General Platform Condition – Kings Highway Station

Figure 2– Precast T-Beam platform – Kings Highway Station

1.24 MR-251 | Avenue U Station

Summary: *Avenue U Station (MR-251) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2). In addition, the stair on the south-end of both platforms is located 2'-8" (32") from the platform edge. In the implementation of a platform edge barrier, the remaining width would not allow for ADA-compliant wheelchair movement (see figure 1).*

Description:

Avenue U Station is an elevated station consisting of two center platforms, one of which is currently not in service. Each center platform is 11'-4" wide. The platform is straight with a row of a columns against the wall of the platform. The canopy covers the entirety of the platform length. The stairs at the south-end of both platforms is close to the platform edge and would not allow for ADA-compliant wheelchair movement with a platform edge barrier installed.

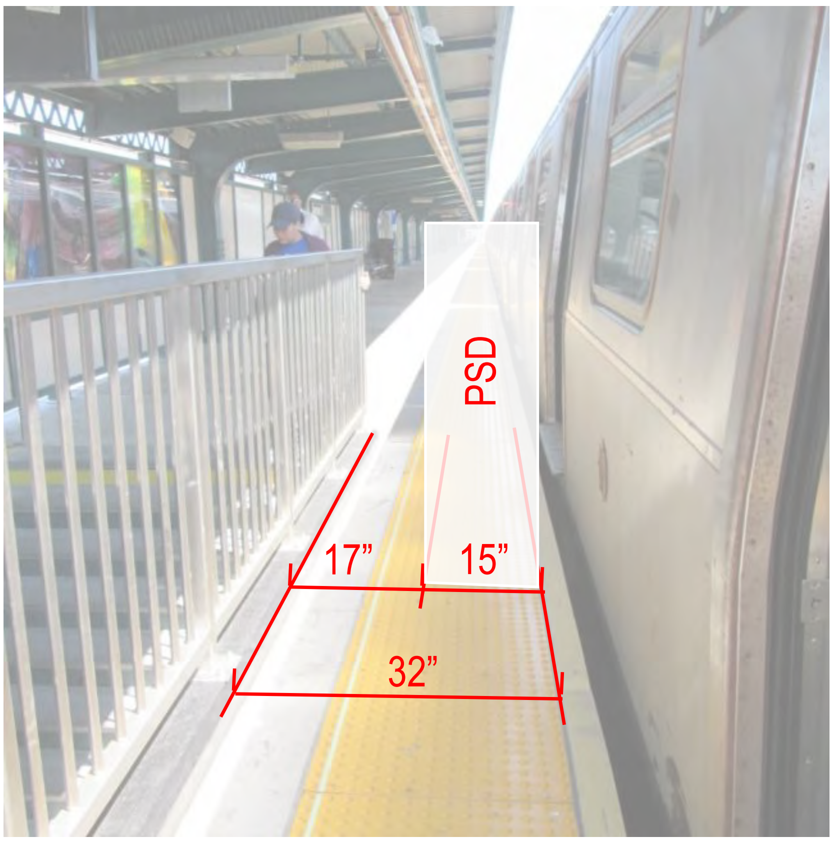

Figure 1– Non-compliant ADA condition at stairs– Avenue U Station

Figure 2– Precast T-Beam platform – Avenue U Station

1.25 MR-252 | Avenue X Station

__Summary:__ Avenue X Station (MR-252) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2). In addition, the stair on the north-end of the Jamaica-bound platform is located 3'-8" (44") from the platform edge. In the implementation of a platform edge barrier, the required 32" width for wheelchair movement would not be met as the remaining width would be 29" (see figure 1).

Description:

Avenue X Station is an elevated station consisting of two side platforms. Each side platform is approximately 10'-0" wide. The platform is slightly curved with a row of a columns against the back wall of the platform. The canopy covers the entirety of the platform length. The stair at the north-end of the Jamaica-bound platform is close to the platform edge. In this location, the required 32" width for ADA compliant wheelchair movement would not be met with a platform edge barrier installed.

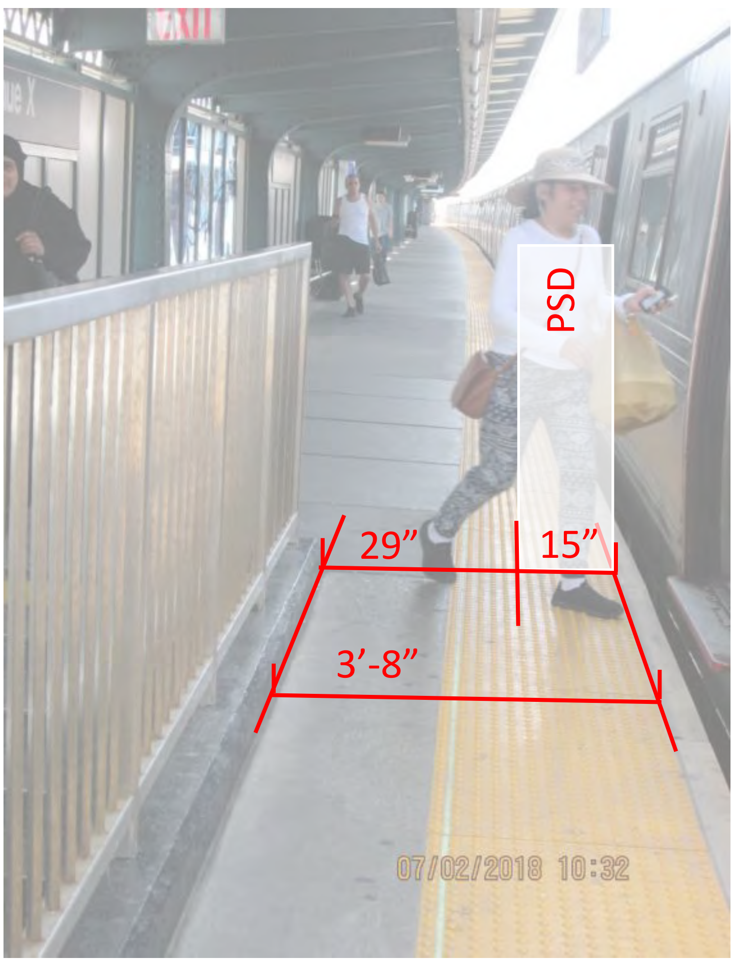

Figure 1– Non-compliant ADA condition – Avenue X Station

Figure 2– Precast T-Beam platform – Avenue X Station

1.26 MR-253 | Neptune Avenue Station

Summary: *Neptune Avenue Station (MR-253) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2). In addition, at the centrally located stairs are 3'-10" (46") away from the platform edge. In the implementation of a platform edge barrier, the required 32" width for wheelchair movement would not be met as the remaining width would be 31" (see figure 1).*

Description:

Neptune Avenue Station is an elevated station consisting of a straight center/island platform. The platform is approximately 15'-2" wide. Columns are centered on the width of the platform. Full height PSDs would not be feasible as there is limited canopy cover. The centrally located stairs are close to the platform edge. Adjacent to the stairs, the required 32" width for ADA compliant wheelchair movement would not be met with a platform edge barrier installed.

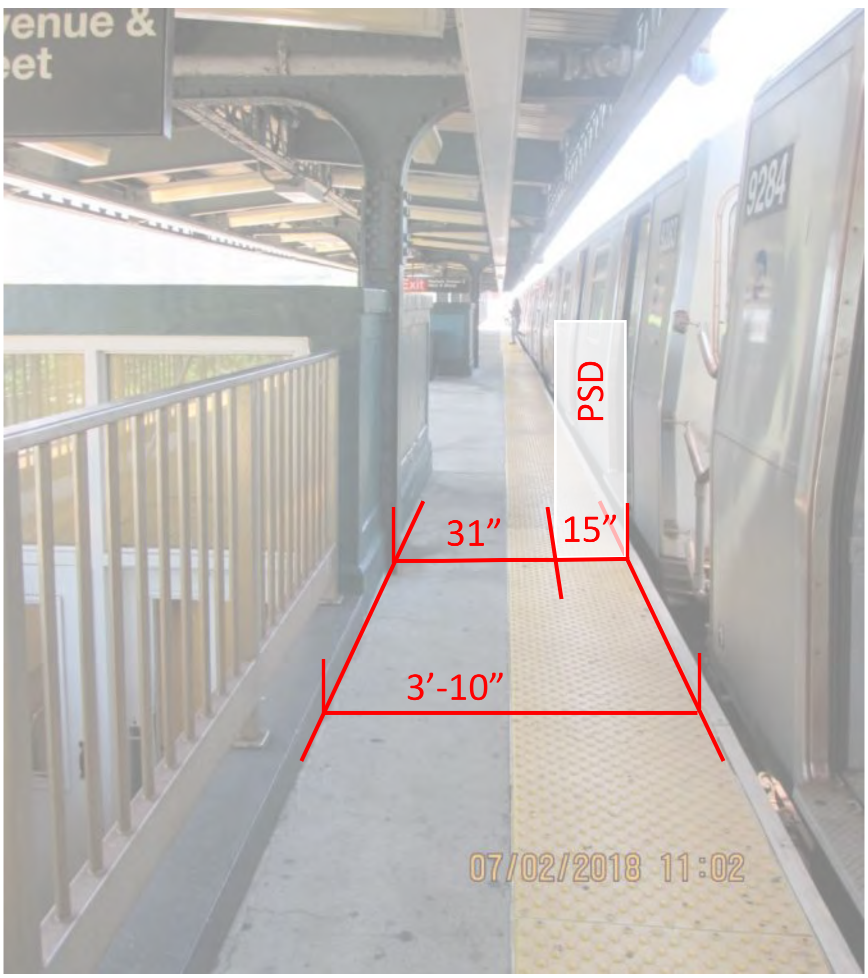

Figure 1– General Platform Condition – Neptune Avenue Station

Figure 2– Precast T-beam Platform – Neptune Avenue Station

1.27 MR-57 | West 8th Street- NY Aquarium Station

Summary: *West 8th Street- NY Aquarium Station (MR-57) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. This issue would occur due to the elevator/escalator room located on the Jamaica-bound platform. A column divides the width between the existing room and the platform edge. This column currently does not allow for wheelchair movement on the Jamaica-bound platform. The 32" minimum requirement for ADA compliant wheelchair movement is currently not met and would be exacerbated in the implementation of a platform edge barrier (see figure 1).*

Description

West 8th Street- NY Aquarium Station is an elevated station with slightly curved side platforms that serve the 'F' and 'Q' trains. The lower platform level serves the 'F' line and the upper platform serves the 'Q' line. The platform structure is cast-in-place concrete. The width of the platform varies from 12'-10" to 5'-2". Columns are typically 2'-3" from the platform edge. Currently, the station does not have an ADA compliant path of travel along the Jamaica-bound platform. The elevator/escalator room is 5'-2" from the platform edge a column segments this width into a 1'-4" and a 2'-4" path of travel. The implementation of a platform edge barrier would further constrain this non-compliant condition.

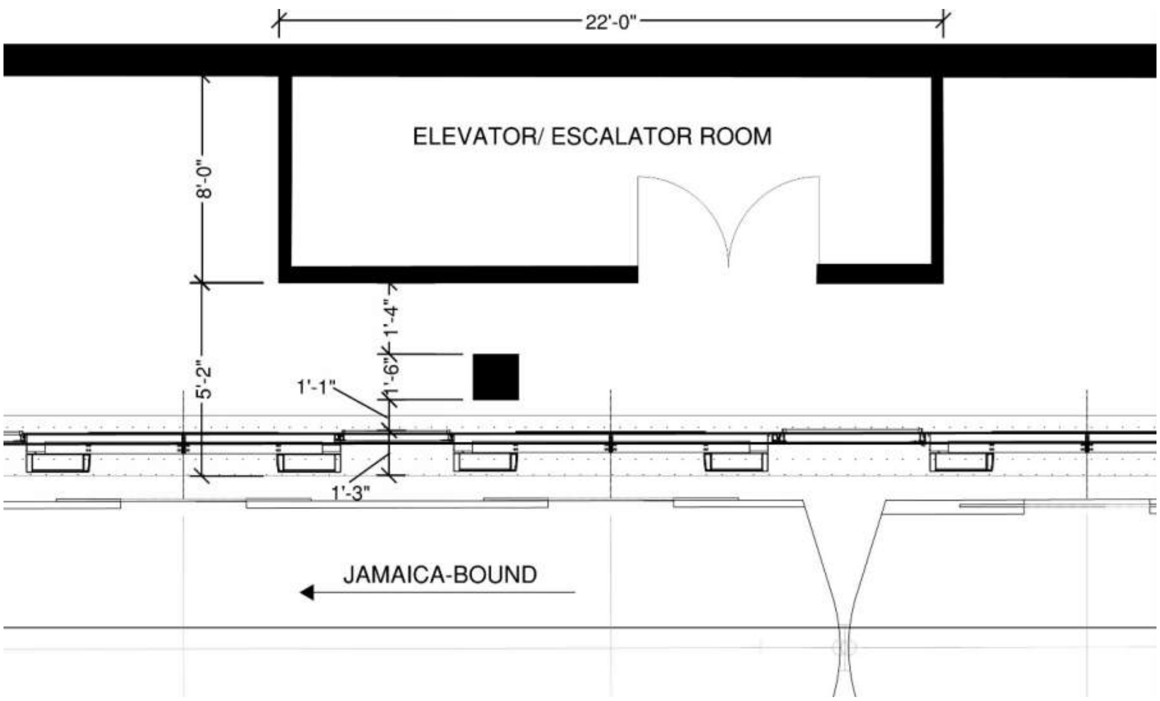

Figure 1 – Non-compliant ADA condition on the Jamaica-bound platform- West 8th St-NY Aquarium

1.28 MR-58 | Coney Island-Stillwell Avenue Station

Summary: *Coney Island-Stillwell Avenue Station (MR-58) is feasible for both APGs and PSDs. This station is the terminus station for the 'N', 'Q', 'D', and 'F' trains. Tracks 5 and 6 serve the F line from a shared center/island platform. The canopy at this station is very tall, and there are no structural members directly above the platform edge. For the installation of a full height PSD system, structural members would have to be attached to existing beams that are approximately 12'-0" high and 5'-0" from the platform edge. One and a half train cars are not covered by a canopy, supplemental overhead structure would be needed in this small along the platform. Platform structural work will be required to support the requirements of an APG and PSD system (see structural report; Appendix B). Existing power is adequate.*

Description

Coney Island-Stillwell Avenue Station is an elevated station with four center/island platforms (see figure 1). Each train that is served at this station has a center/island platform for its use only. The 'F' line platform is mostly straight, but tapers at the north-end of the platform. The platform structure is made of cast-in-place concrete. There are two stairs and a centrally located ramp that provide access to the mezzanine level below. Back-of-house elements are situated on the platform ends and in the mezzanine. There are two rows of columns along the length of the platform. These columns are spaced approximately 20'-0" on center with column faces 6'-10" from the platform edge. The platform varies from 20'-0" to 26'-0" wide. One and a half train cars are not covered by the canopy, a supplementary overhead structure would be required in these locations to accommodate a platform edge barrier. See figure 1 for an overall station plan.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. As indicated in the summary, there is not structure to mount to directly above the platform edge, some additional framing would be needed in this station (see figure 3).

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, entrapment prevention sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be CCTV cameras over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Minimal overhead structure would be needed to accommodate cameras and sensors in the small portion of the platforms not covered by canopies

Equipment Room

One room can be accommodated on the platform between columns at the center of the platform. The proposed room would measure approximately 16'-0" x 7'-6" (see figure 2). The other lines that are served at this station could use a similar room location on their respective platform (see figure 1)

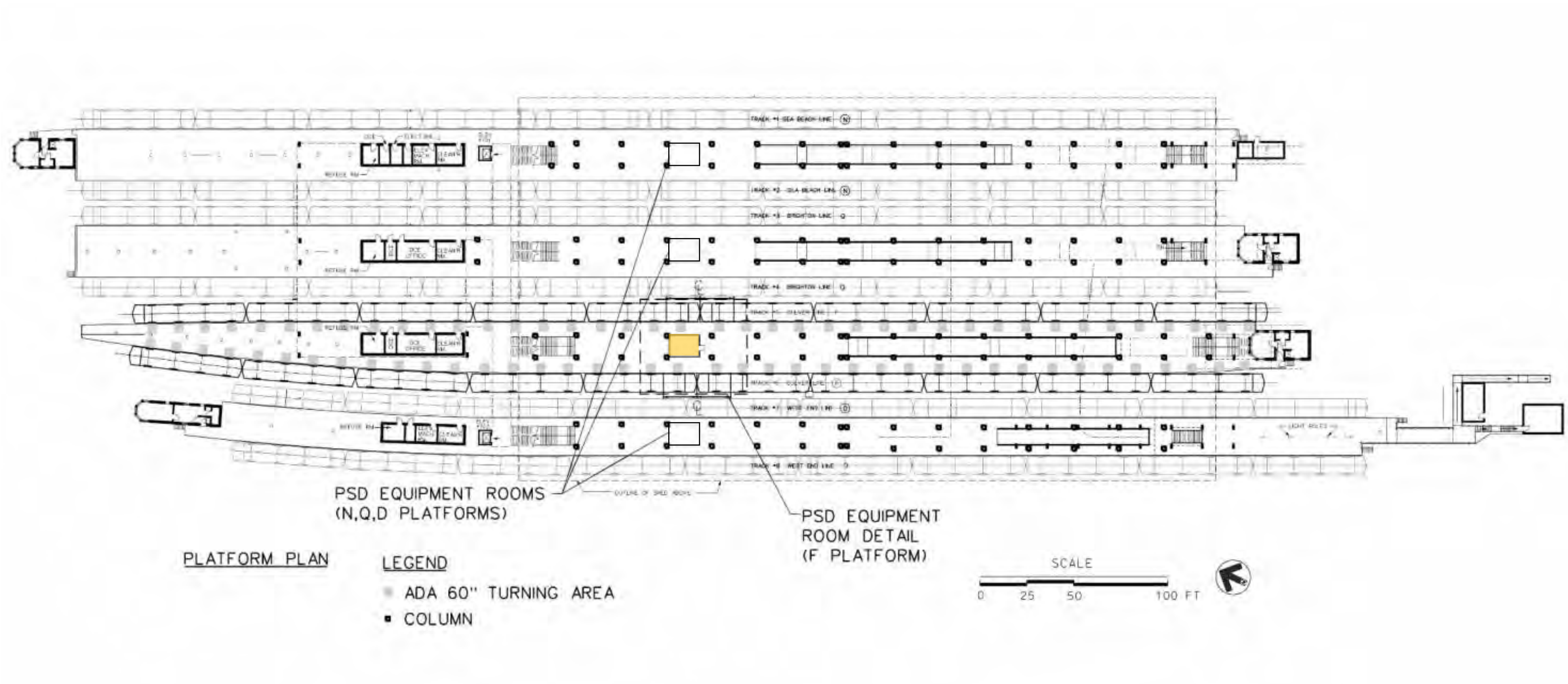

Figure 1 – Station Plan- Coney Island-Stillwell Avenue Station

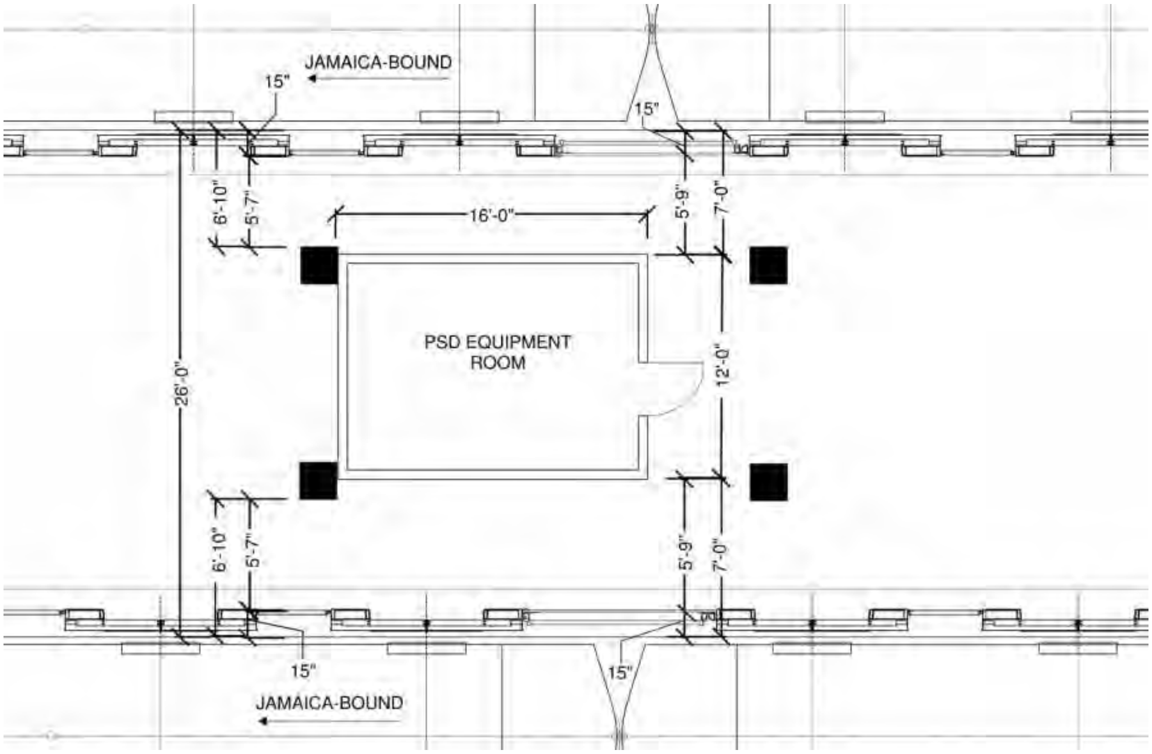

Figure 2 – PSD Equipment Room Detail – Coney Island-Stillwell Avenue Station

Track Layout

Tracks are mostly tangent with the exception of the tapered north-end of the platform. Thus, we are expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

Existing conditions. The 2012 NYCT conditions survey for this station could not be obtained at the time of drafting this report. However it should be noted this station underwent a major rehabilitation in 2005. It can be safely assumed that major reconstruction would be required to implement either a PSD or APG system at this station. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would be required for the installation of an APG system and PSD system. The APG due to its cantilevered configuration and the PSD due to there being no components above it to mount to provide support and stability.

Platform obstructions within 5' of edge:

None.

Lighting:

Existing lighting: This station has a lot of natural daylight, however there are also linear fluorescent lights below the beams that run parallel to the platform. These beams are approximately 12'-0" high and 5'-0" from the edge of the platform. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 and Table 2 please see the Power Capacity Analysis for this station. MRN 058 has adequate capacity to support the implementation of a APG/PSD system only through the reserve system. The Normal EDR possesses inadequate capacity

Station (Reserve)
Power Capacity Analysis

NYCT Station MR Number	58
Station Name	Coney Island Stillwell / Surf Ave
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	112.0
Apparent Power (kVA)	140.0
Station Peak Demand Load, Max Current, (A)	388.9
Maximum Amount of Doors	320.0
PSD Total Load Including All Miscellaneous Loads, (A)	632.6
Total Load (Station Peak + PSD), (A)	1022
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	179
Is Electrical Service Adequate?	Yes
Notes	This is for Reserve service only. This is based on assumption that each Service is separate.Reserve service has spare capacity. (Normal service has **NO** spare capacity). See Analysis (N) tab.

Table 1. MRN 058 Reserve Capacity Analysis

Station (Normal)
Power Capacity Analysis

NYCT Station MR Number	58
Station Name	Coney Island Stillwell / Surf Ave
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	552.0
Apparent Power (kVA)	690.0
Station Peak Demand Load, Max Current, (A)	1916.7
Maximum Amount of Doors	320.0
PSD Total Load Including All Miscellaneous Loads, (A)	632.6
Total Load (Station Peak + PSD), (A)	2549
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	0
Is Electrical Service Adequate?	**No**
Notes	This is for Normal service only. Station has (2) separate meter readings (not combined). Normal service has exceeded its service rating. **NO** additional load be connected to this normal service. See Analysis (R) tab.

Table 1. MRN 058 Normal Capacity Analysis

Historic Restrictions:
None.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached

ROM estimate. The total cost for this station (only the F-line platform edges and equipment room) is estimated to be $32.2M to install APGs and $41.0M to install PSDs (See Appendix E).

:


Figure 3 – Typical platform edge condition with line of potential supplementary framing- Coney Island-Stillwell Avenue Station

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*
>
> a. *Column location in relation to the platform edge*
> b. *Platform edge clearance adjacent to stairs and other impediments*
> c. *Impacts to ADA path of travel and boarding areas*
> d. *Conflicts of PSD/APG/RPSDs with Signals cables*
> e. *Sufficient platform width*
> f. *Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*
>
> a. *Structural capacity of platforms to accept PSD/APG/RPSDs*
> b. *Feasibility & location for PSD/APG/RPSDs equipment room*
> c. *Confirmation of adequate power for PSD/APG/RPSDs*
> d. *Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> e. *Determination of communications requirements, availability and cost*
> f. *Determination of gap detection and entrapment avoidance technology requirements*
> g. *Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
    - Double the amount of motors as PSDs (each motor operating a single leaf).
    - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
    - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
    - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

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If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	**Dedicated Loop**	**Wayside Only**
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

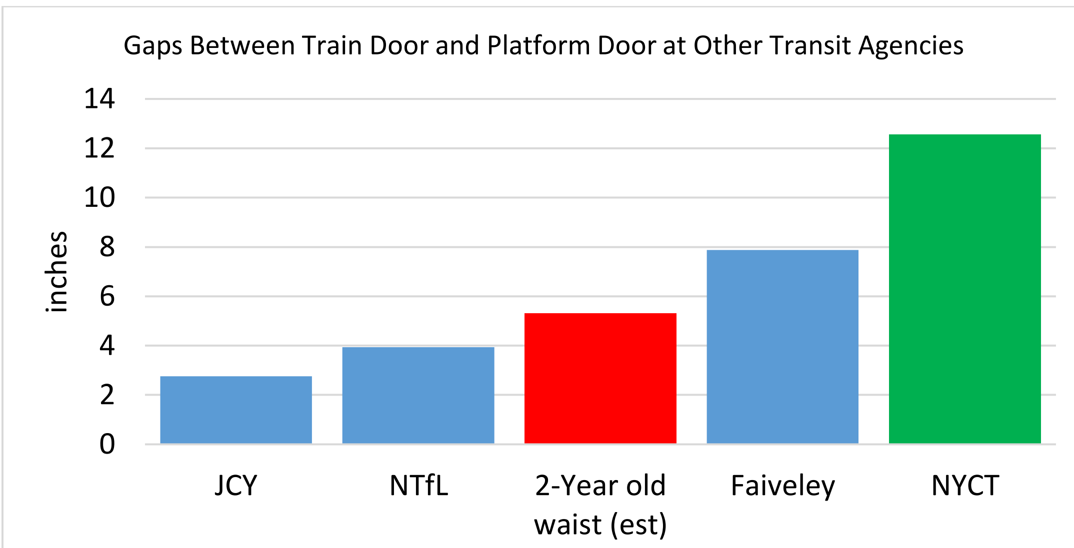


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

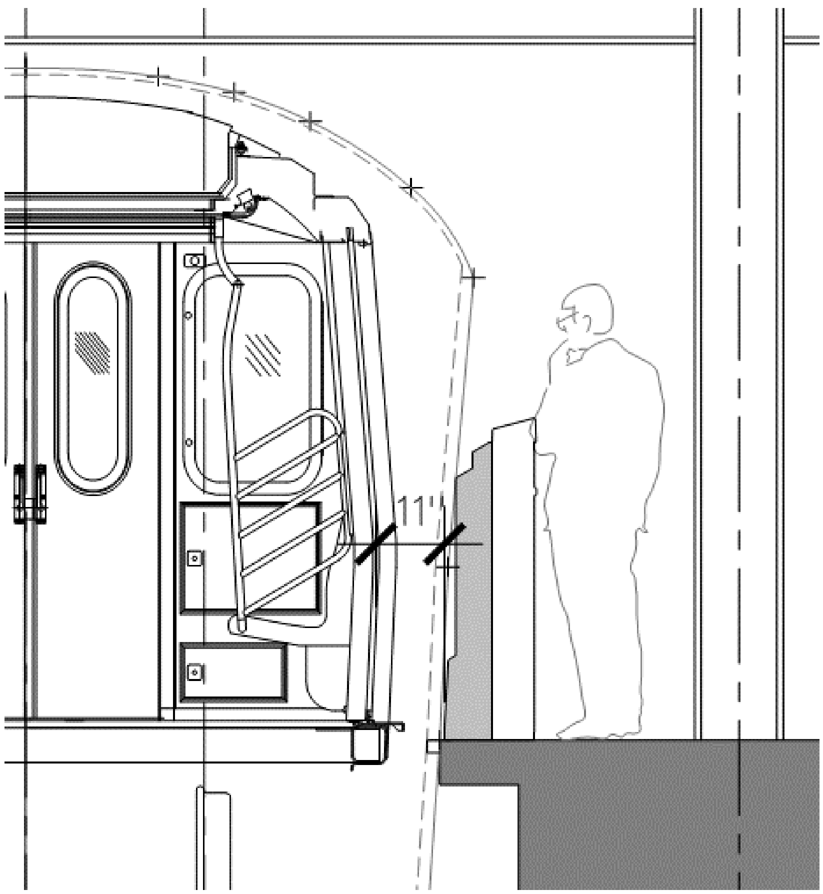


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

Impact per station

2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

Impact per station

3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber “bumpers” on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6” into the line equipment envelope. This would leave a 5” gap between the platform and car doors allowing approximately 2” of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5" by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor's window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor's window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **<u>bold/underline</u>**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	PSD System 1	PSD System 2	PSD System 3
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are “existing” as defined by code. All the rolling stock is also to be considered “existing” under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60” radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36” of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

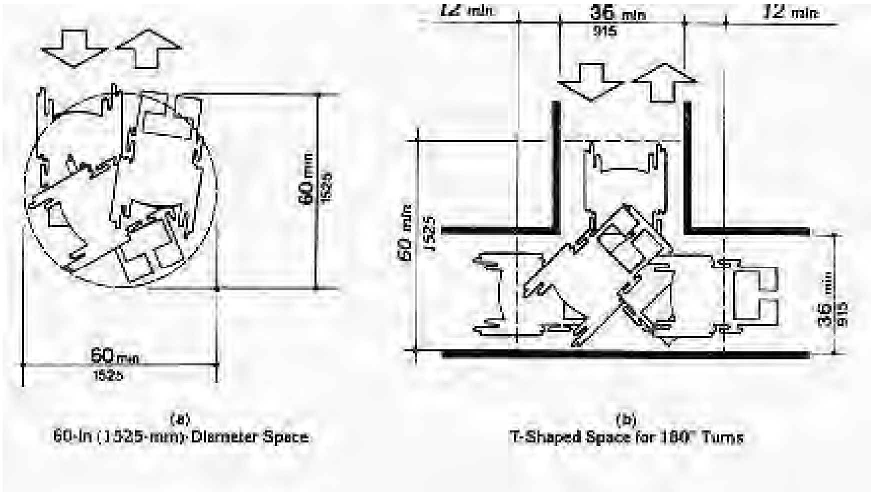
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

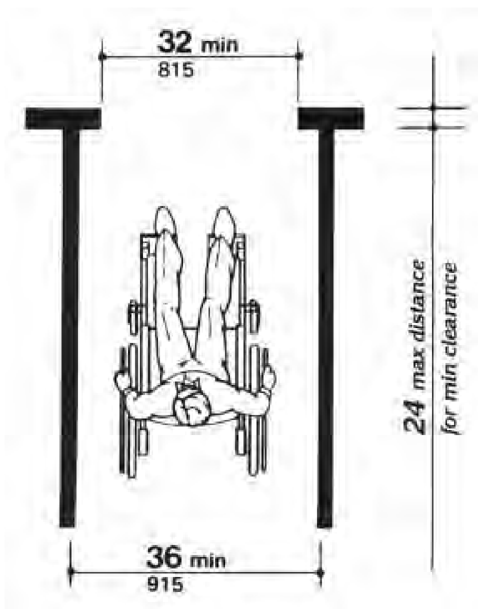


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

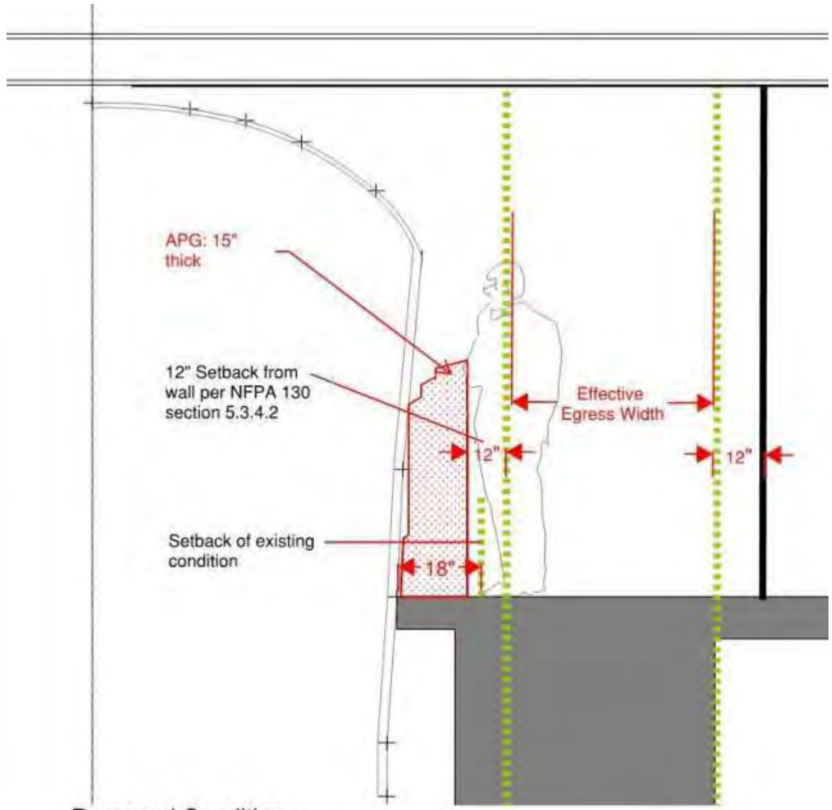
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15" of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

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Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

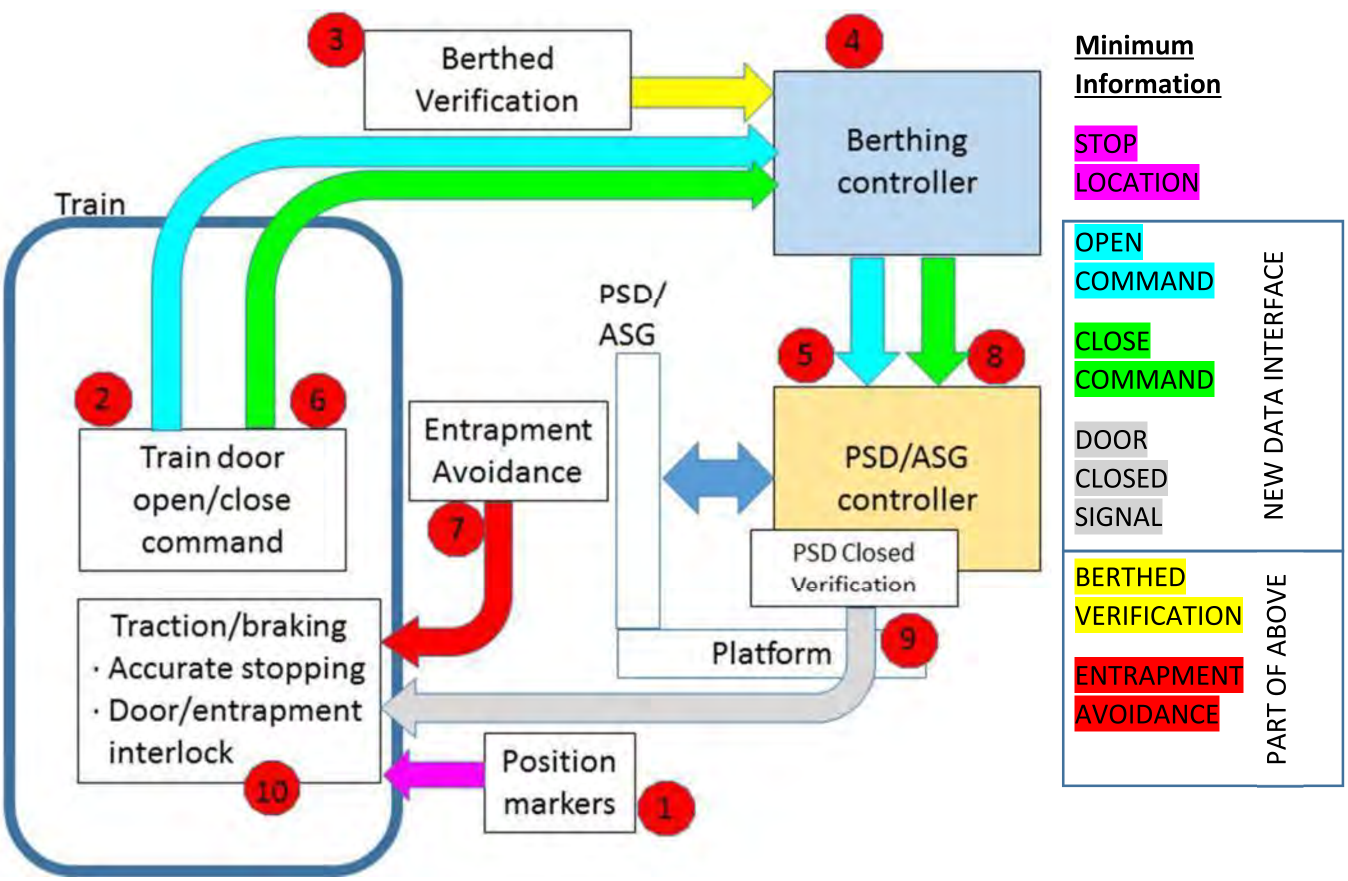
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

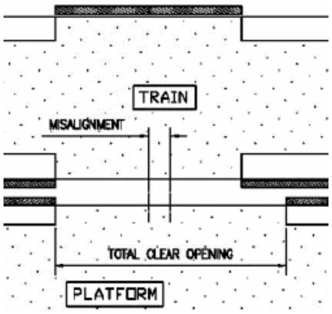
C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5" clear opening, a design for NY should meet the ADA Accessibility Guideline of 36".

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a 'distance totem' which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy's COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically

If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.

For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

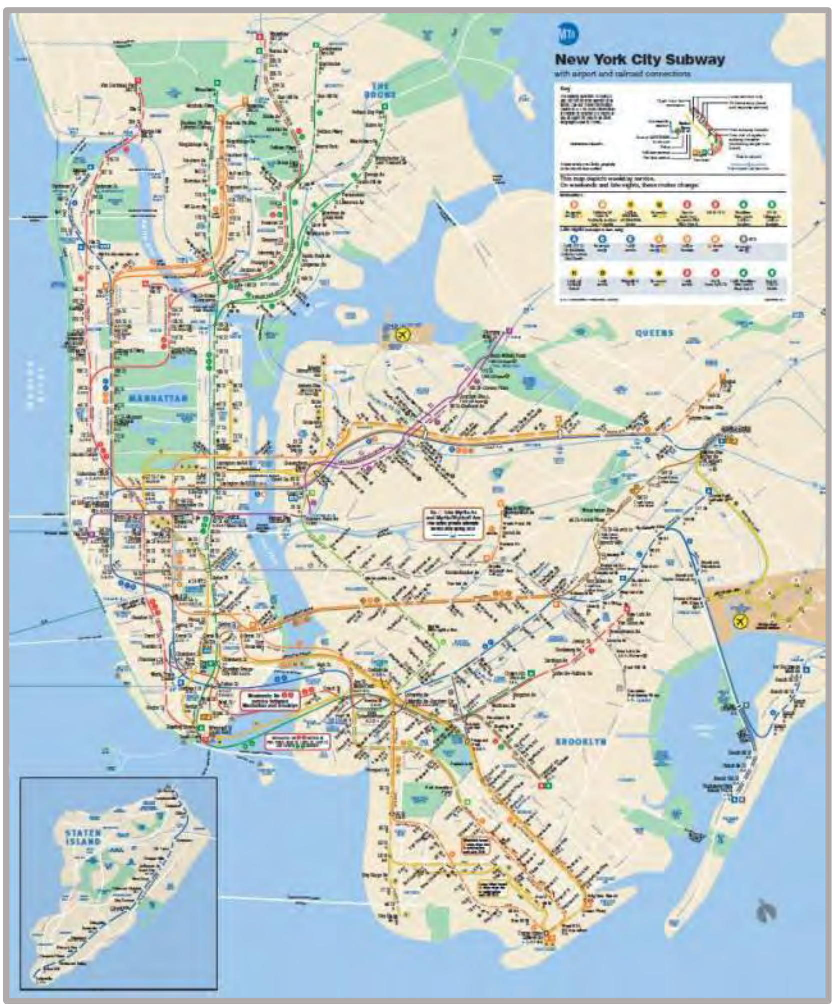


Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4’-0”). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

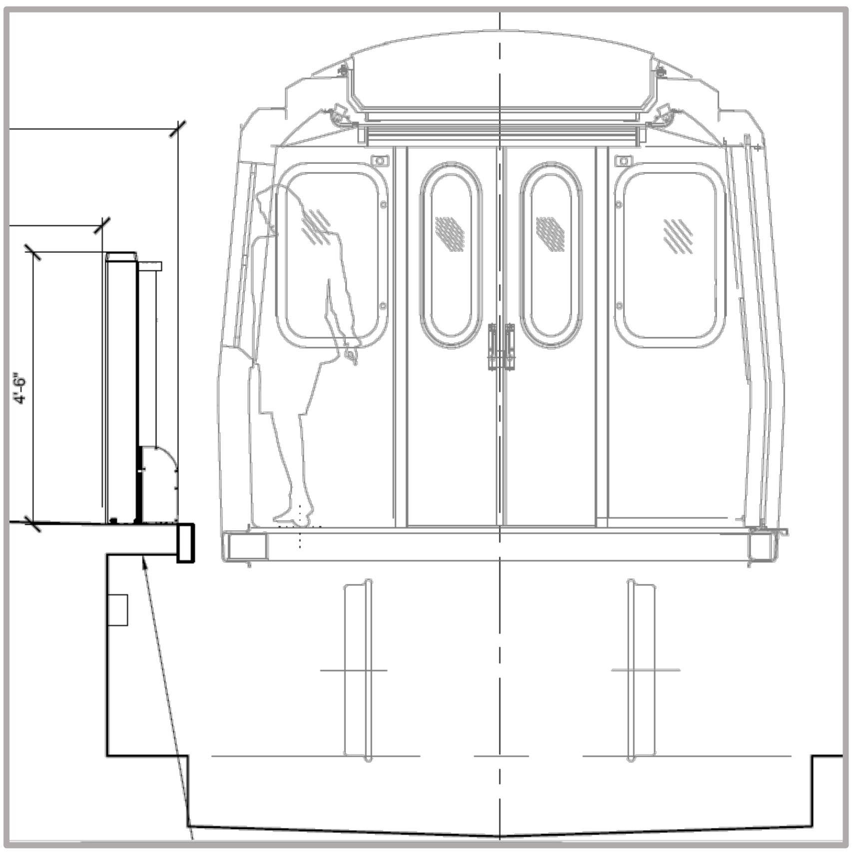


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

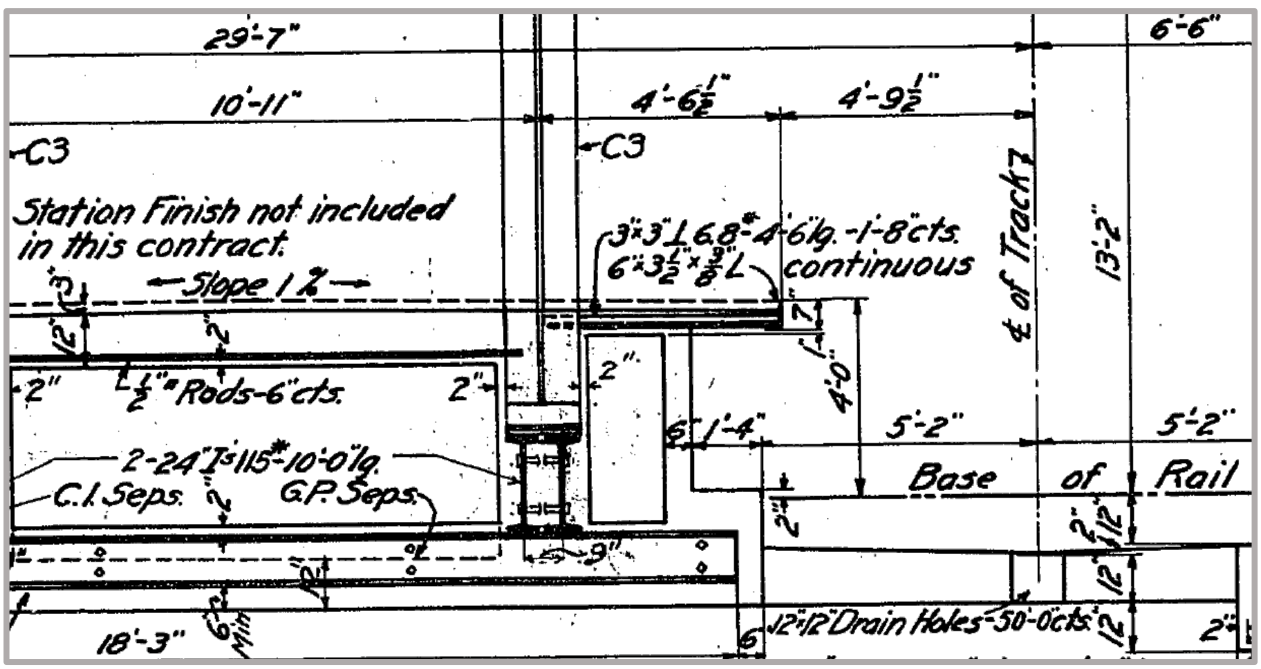


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

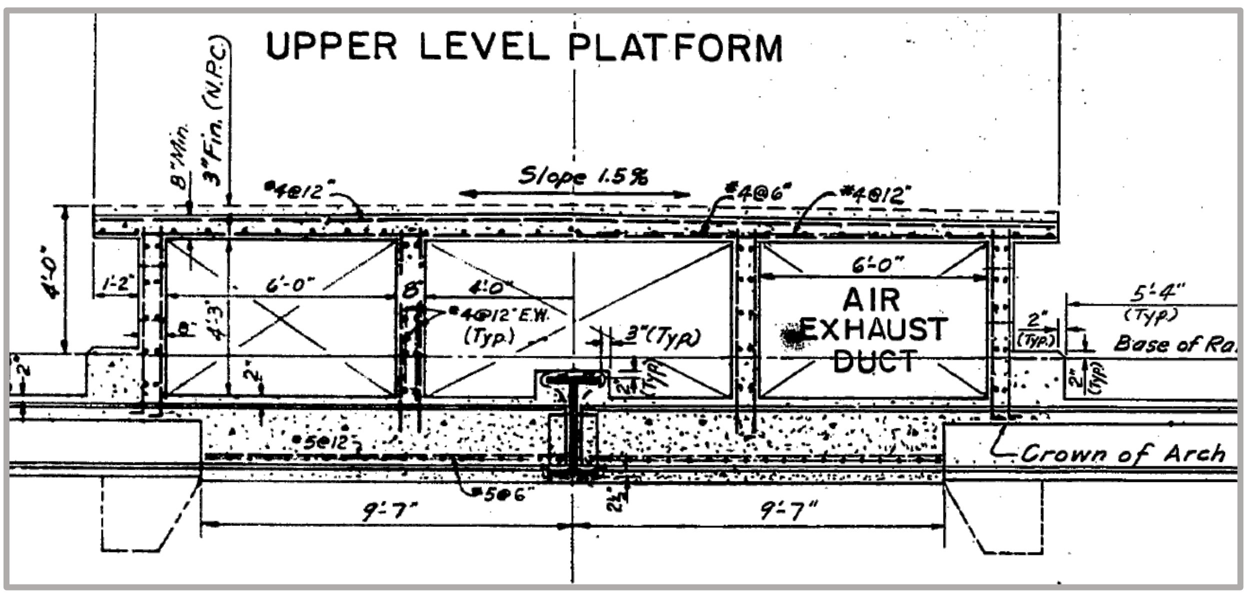


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

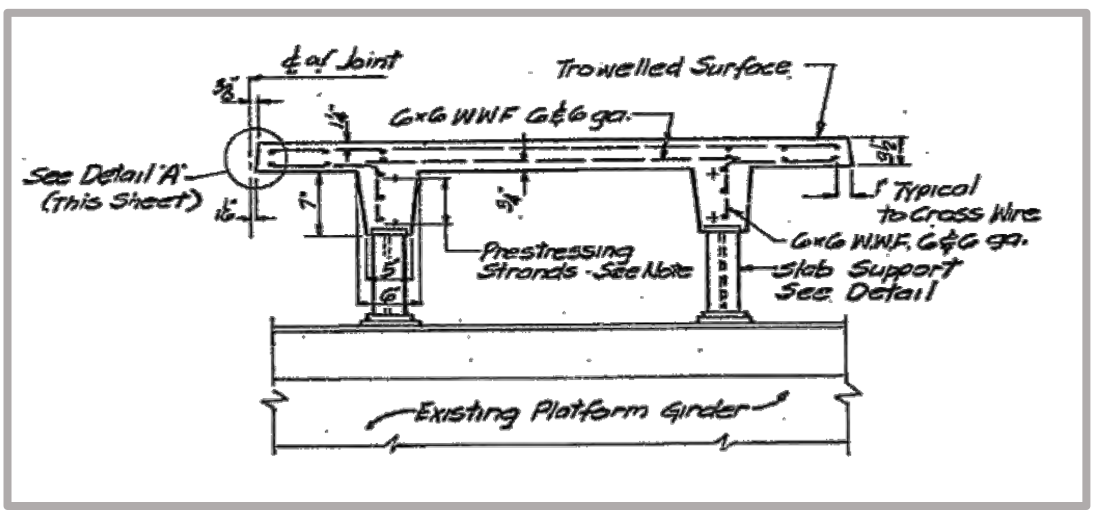


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

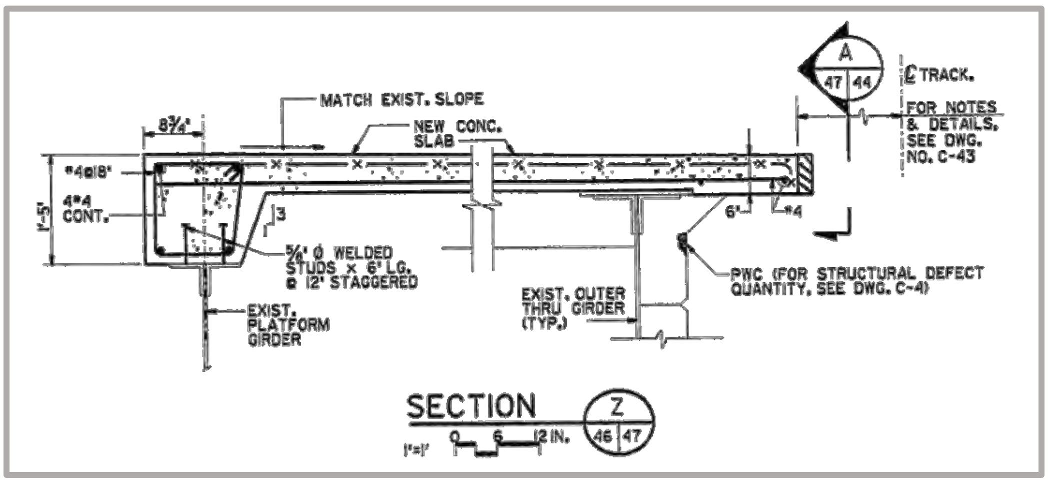


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2’-9”), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

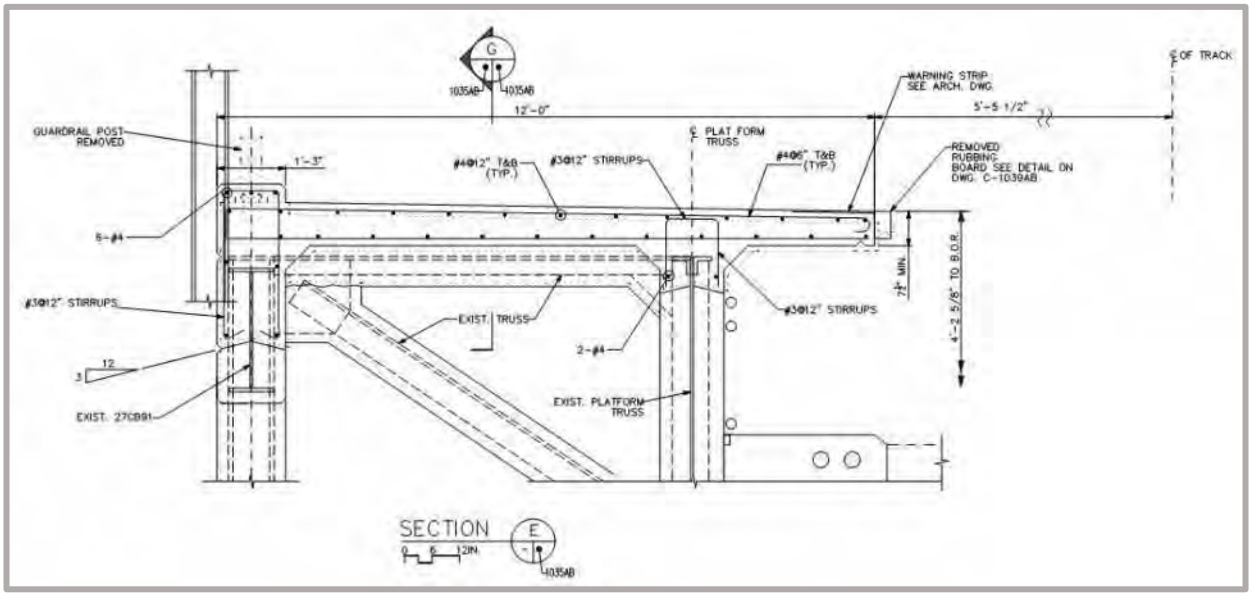


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3" thick structural slab with an approximately 3" thick topping slab. If the topping slab is fully removed, a 6" thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6" thick slab will be sufficient for a cantilever length of up to approximately 3'-0", greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6" structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6" minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

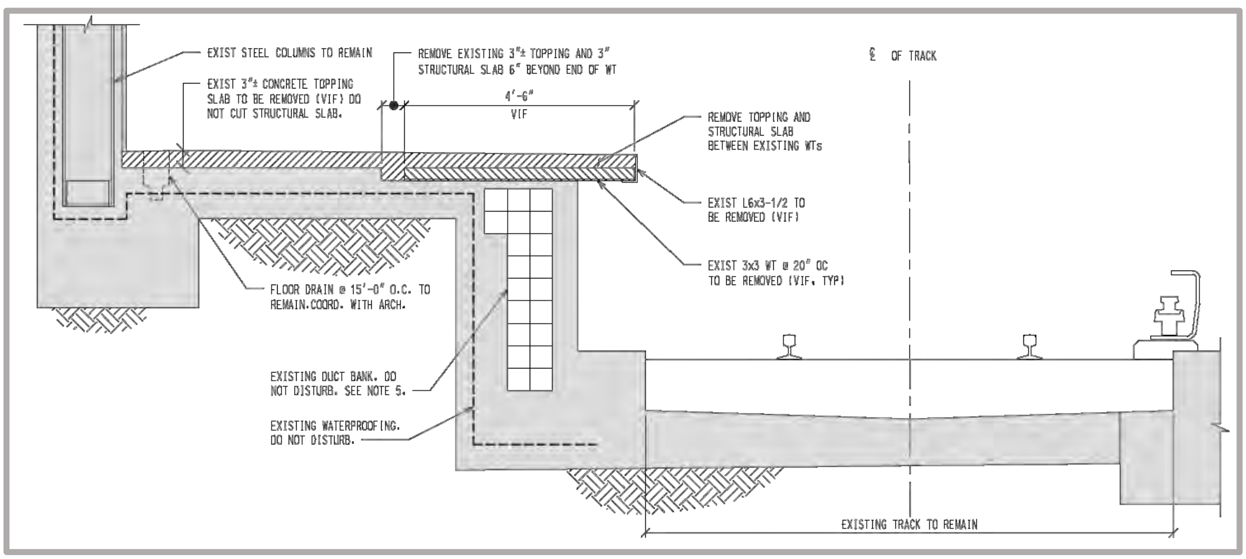


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

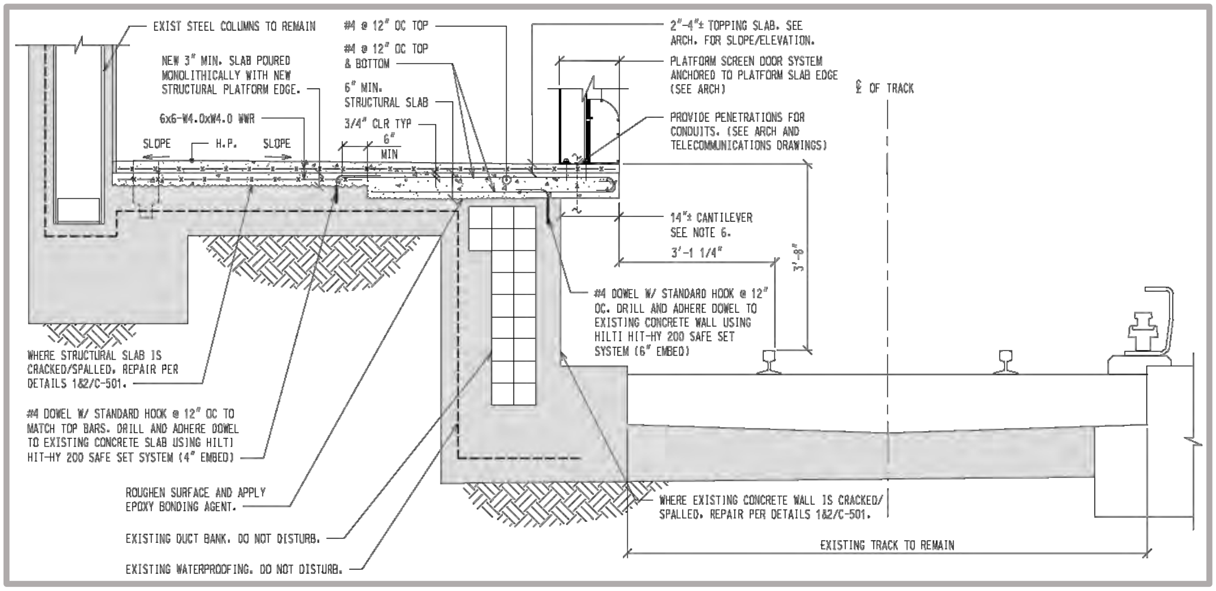


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

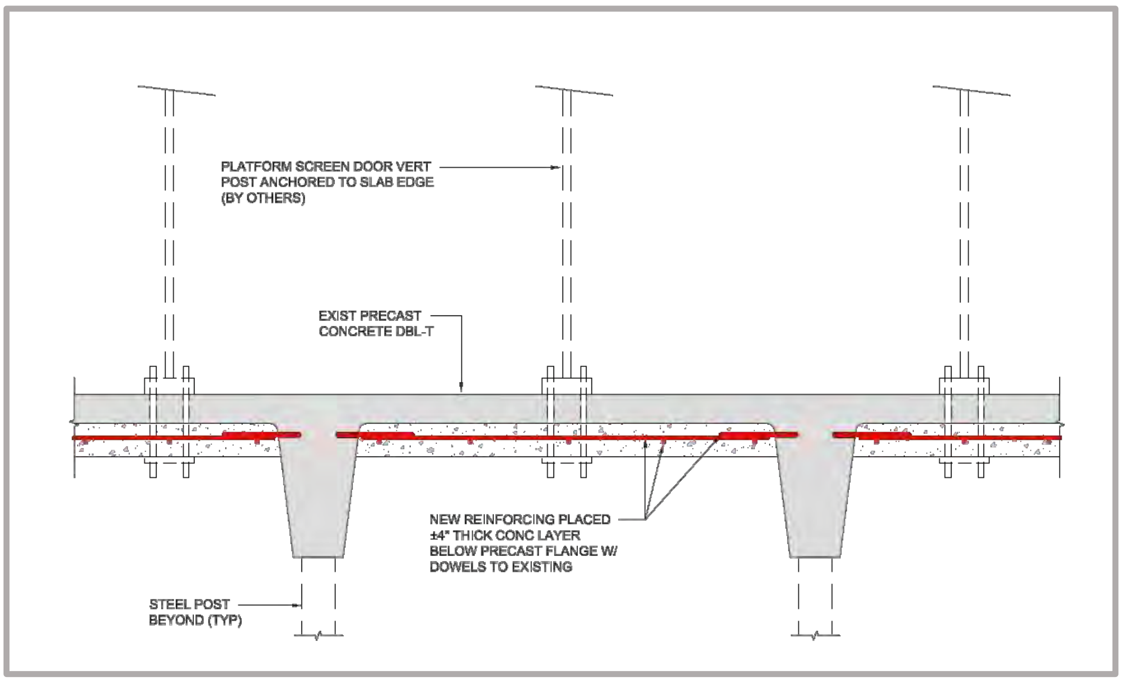


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5' – 11" of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis

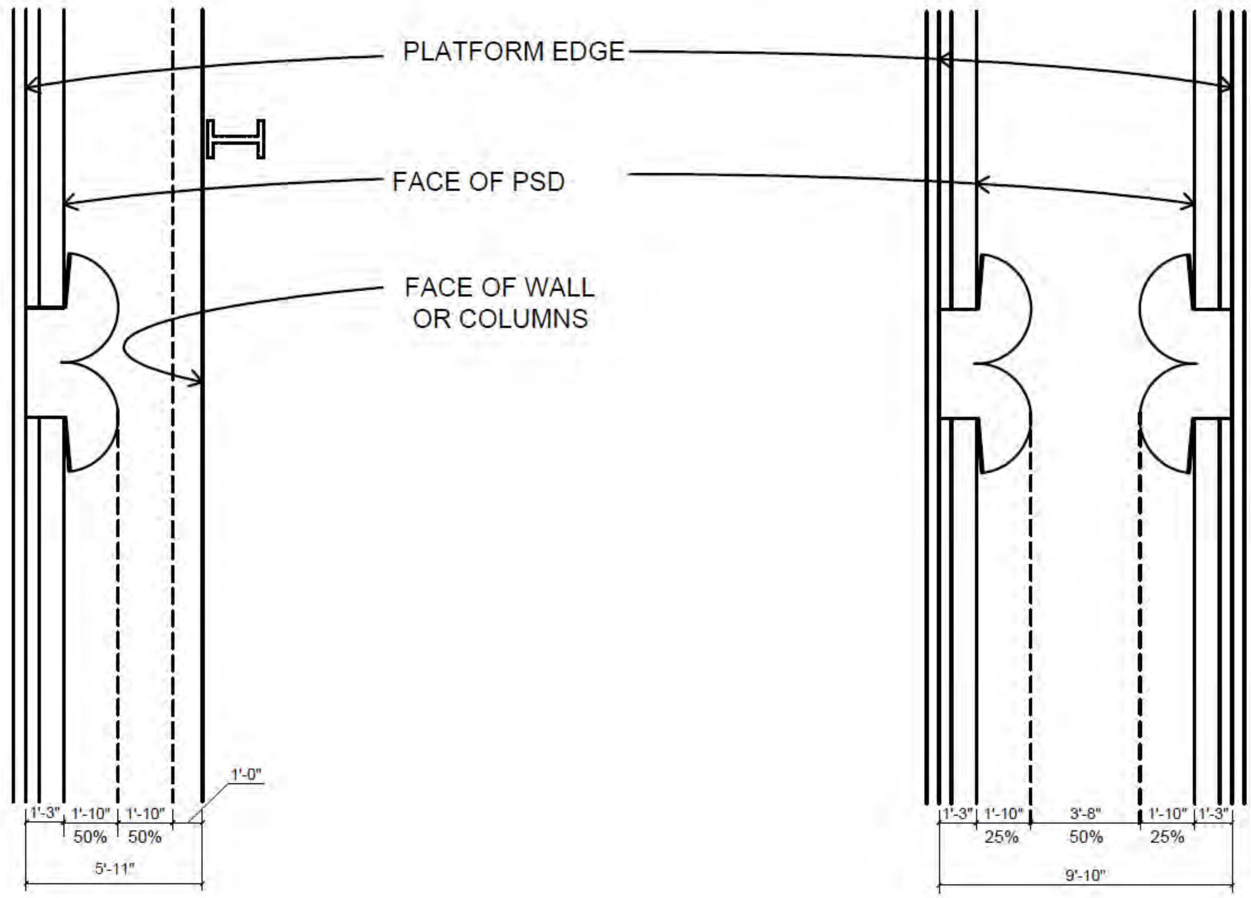


FIGURE 1: SIDE PLATFORM **FIGURE 2: CENTER PLATFORM**

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	9	$ 63,500 per month [Year 01]	$ 571,500		
		12	$ 83,590 per month [Year 02]	$ 1,003,080		
		12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment.	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
		12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663		

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT
7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *	
		Year 3	$ 257 per hour *	
	Optional :	Year 4	$ 268 per hour *	
	Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations
ESTIMATE DATE:	October 4, 2018

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VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

MTA/NYCT

October 4, 2018

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs / PSDs will provide 39 emergency egress doors with push bars per platform*
1.2 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.3 *Each platform edge will have 50 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.2 In respect of the PSD option, only platforms that have not been upgraded in the recent past (assuming over the past two decades) will require platform edge replacement.
2.3 There are no special security requirements made necessary by installation of the APG system
2.4 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.5 This estimate does not provide for the replacement of Platform Edge Lighting
2.6 Premium cost for night time work is considered 50% of total labor cost

3.0 ***Exclusions - Costs not included in the estimate:***

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

MTA/NYCT

October 4, 2018

BASIS OF ESTIMATE

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems
3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length
3.4 Costs associated with NYCT State Of Good Repair improvements to the station
3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.
3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs
3.7 Escalation Cost is not included; Anticipate at 5% per annum.
3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.
3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium
3.10 NYCT project cost is not included
3.11 GO and flagging cost is not included
3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or "soft" costs:***

4.1 Design and Construction Contingency
4.2 Contractor O & P
4.3 Insurance
4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 *Given the limited time available, no drawings were developed to support this estimate.*

MTA /NYCT

October 4, 2018

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations
IRT Flushing Line Stations

ORDER OF MAGNITUDE COSTS			MR-221	MR-222	MR-223	MR-235	MR-255
DESCRIPTION			21ST ST. - QUEENSBRIDGE	ROOSEVELT ISLAND	LEXINGTON AVE - 63RD ST.	YORK ST.	STILLWELL AVE - CONEY ISLAND
1	AUTOMATIC PLATFORM GATES (APG'S)		$16,639,268	$16,706,054	$16,732,028	$17,238,933	$17,058,603
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$16,639,268	$16,706,054	$16,732,028	$17,238,933	$17,058,603
4	GENERAL REQUIREMENTS	15.00%	$2,495,890	$2,505,908	$2,509,804	$2,585,840	$2,558,790
	SUB-TOTAL:		$19,135,158	$19,211,962	$19,241,832	$19,824,773	$19,617,393
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,783,790	$4,802,991	$4,810,458	$4,956,193	$4,904,348
	SUB-TOTAL:		$23,918,948	$24,014,953	$24,052,291	$24,780,967	$24,521,741
6	OVERHEAD & PROFIT	15.00%	$3,587,842	$3,602,243	$3,607,844	$3,717,145	$3,678,261
	SUB-TOTAL:		$27,506,790	$27,617,196	$27,660,134	$28,498,112	$28,200,002
7	BONDS & INSURANCE	3.75%	$1,031,505	$1,035,645	$1,037,255	$1,068,679	$1,057,500
	SUB-TOTAL:		$28,538,295	$28,652,841	$28,697,389	$29,566,791	$29,257,502
	SUB-TOTAL:		$28,538,295	$28,652,841	$28,697,389	$29,566,791	$29,257,502
	SUBTOTAL CONSTRUCTION COST W/O ACM		**$28,538,295**	**$28,652,841**	**$28,697,389**	**$29,566,791**	**$29,257,502**
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		**$28,538,295**	**$28,652,841**	**$28,697,389**	**$29,566,791**	**$29,257,502**
10	DESIGN CONSULTANT FEES	10.00%	$2,853,829	$2,865,284	$2,869,739	$2,956,679	$2,925,750
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST		$31,392,124	$31,518,125	$31,567,128	$32,523,470	$32,183,253

	ADD ALTERNATIVES						
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		4,445,722	4,908,488	4,059,284	4,603,823	4,682,415
	Add for Markups (as above)	88.66%	3,941,705	4,352,007	3,599,078	4,081,883	4,151,564
			$8,387,427	$9,260,496	$7,658,362	$8,685,706	$8,833,979

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: 21ST STREET - QUEENSBRIDGE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	607	LF		
5	LENGTH OF THE PLATFORM EDGE [QUEENS BOUND] =	615	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,222**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,222	LF	7	8,554
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,110	SF	12	73,320
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	123	CY	2,500	307,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,224	EA	25	30,600
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,224	EA	25	30,600
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,222	LF	95	116,090
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,222	LF	15	18,330
26	Remove existing platform tiles	1,222	LF	12	14,664
27	Sawcut existing topping concrete at perimeter of removal area	1,222	LF	5	6,110
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,332	SF	8	58,656
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 12'-6" wide strip	572	SF	8	4,576
30	New Work				
31	New concrete topping to match existing	1,222	SF	15	18,330
32	New concrete topping at ADA boarding area to match existing	572	SF	15	8,580

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: 21ST STREET - QUEENSBRIDGE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	189	SF	30	5,670
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	410	SF	40	16,400
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
46	Concrete cove to match existing	41	LF	20	820
47	Interior Wall Finish - Paint	410	SF	5	2,050
48	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
49	Allow for 4" thick concrete pads for equipment	47	SF	20	945
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,214	SF	750	1,660,500
61	Spare Parts - Approx. 10% of Material Cost	1	LS	226,290	226,290
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
71	Allow for conduit / cable runs for power and communications under platform edge	1,222	LF	60	73,320

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: 21ST STREET - QUEENSBRIDGE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
74	Power to PSD Room from EDR including track crossing if needed	250	LF	60	15,000
75	Reserve power to PSD Room from EDR including track crossing if needed	750	LF	60	45,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
79	MISC				
80	Testing and commissioning	1	LS	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	2,000	Hrs	160	319,860
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: 21ST STREET - QUEENSBRIDGE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,839,831	3,839,831
113	TOTAL PSD WORK:				$ 16,639,268

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,910	SF	750	3,682,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	419,062	419,062
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,135
129	L6x6x1/2 continuous angle	9	TONS	17,500	157,394
130	Drilling and bolting - 4 bolts at each connection	489	EA	216	105,581
131	Extra Structure frame at locations with different ceiling height; Approx. 100' long	1	LS	300,000	300,000
132	Platform Edge Repair - **Not Required**				
133	Remove concrete platform edge	-	LF	27	-
134	Platform edge repair	-	LF	109	-
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	-	EA	10	-
136					
137	OMIT				
138	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
139	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
140	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
141	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: 21ST STREET - QUEENSBRIDGE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
142	Fixed Panels including framing and support; 4'-6" High	(2,214)	SF	750	(1,660,500)
143	Spare Parts - Approx. 10% of Material Cost	(1)	LS	226,290	(226,290)
144	Platform Edge Reconstruction work	(1)	LS	557,220	(557,220)
145	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
146	Conduit running under Platform Edge	(1,222)	LF	30	(36,660)
147					
148	Allow loss of production to work at night say 50%	1	LS	1,025,936	1,025,936
149					
150	**PREMIUM ASSOCIATED WITH PSD's**				**4,445,722**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: ROOSEVELT ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	615	LF		
5	LENGTH OF THE PLATFORM EDGE [QUEENS BOUND] =	615	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,230**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,230	LF	7	8,610
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,150	SF	12	73,800
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,232	EA	25	30,800
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,232	EA	25	30,800
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,230	LF	95	116,850
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,230	LF	15	18,450
26	Remove existing platform tiles	1,230	LF	12	14,760
27	Sawcut existing topping concrete at perimeter of removal area	1,230	LF	5	6,150
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,380	SF	8	59,040
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 12' wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,230	SF	15	18,450
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: ROOSEVELT ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
39	CMU Wall for equipment room	410	SF	45	18,450
40	Vertical connections with existing structure	20	LF	25	500
41	Fire rated door including frame & hardware	1	EA	2,500	2,500
42	Exterior wall finish				
43	Ceramic Tiling to match existing	410	SF	40	16,400
44	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
45	Concrete cove to match existing	41	LF	20	820
46	Interior Wall Finish - Paint	410	SF	5	2,050
47	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
48	Allow for 4" thick concrete pads for equipment	47	SF	20	945
49	Allowance for Mechanical Scope	1	LS	40,000	40,000
50	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
51	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
52	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
53					
54	**Automatic Platform Gates [APGs] - 4'-6" High**				
55	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
56	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
57	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
58	Platform End Gates (PEGs)	4	EA	13,000	52,000
59	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
60	Spare Parts - Approx. 10% of Material Cost	1	LS	227,910	227,910
61	Testing and commissioning	800	HRS	160	127,944
62	Product Warranty	1	LS	1,000,000	1,000,000
63	Allowance for Braille Signage	80	EA	2,500	200,000
64					
65	**Electrical**				
66	Electrical Upgrades				
67	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
68	Power and Lighting				
69	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
70	Allow for conduit / cable runs for power and communications under platform edge	1,230	LF	60	73,800

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: ROOSEVELT ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	PSD Connections	1	LS	75,000	75,000
72	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
73	Power to PSD Room from EDR including track crossing if needed	650	LF	60	39,000
74	Reserve power to PSD Room from EDR including track crossing if needed	750	LF	60	45,000
75	No allowance for new lighting as if APG's are used		Note		EXCL.
76	Grounding				
77	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
78	MISC				
79	Testing and commissioning	1	LS	30,000	30,000
80	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
81					
82	**Communications**				
83	FA System				
84	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
85	CCTV coverage				
86	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
87	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
88	Berthing Technology Sensors				
89	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
90	Train Door Detection System				
91	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
92	Entrapment concerns				
93	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
94	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
95	Engineering and Testing	2,000	Hrs	160	319,860
96	Centralized monitoring/control				
97	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
98	MISC				
99	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
100	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
101	Site Survey and Inspections	1	LS	100,000	100,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: ROOSEVELT ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
103	Furnish Test Equipment allowance	1	LS	500,000	500,000
104	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
105					
106	**Training**				
107	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
108					
109	**Out of hours Work**				
110	Allow loss of production to work at night say 50%	1	LS	3,855,243	3,855,243
111					
112	**TOTAL PSD WORK:**				**$ 16,706,054**

114					
115	**ADD ALTERNATIVE**				
116					
117	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
118					
119	**ADD**				
120	Relocate existing platform edge light fittings and lighting supports including modifying / extending existing circuits	1,230	LF	375	461,250
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,974	SF	750	3,730,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	421,942	421,942
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,657
129	L6x6x1/2 continuous angle	9	TONS	17,500	158,424
130	Drilling and bolting - 4 bolts at each connection	492	EA	216	106,272
131	Platform Edge Repair [Ambiguity on Drawing information]				
132	Remove concrete platform edge	1,230	LF	27	33,210
133	Platform edge repair	1,230	LF	109	134,070
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
135					
136	**OMIT**				
137	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: ROOSEVELT ISLAND

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
141	Fixed Panels including framing and support; 4'-6" High	(2,250)	SF	750	(1,687,500)
142	Spare Parts - Approx. 10% of Material Cost	(1)	LS	227,910	(227,910)
143	Platform Edge Reconstruction work	(1)	LS	560,600	(560,600)
144	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
145	Conduit running under Platform Edge	(1,230)	LF	30	(36,900)
147	Allow loss of production to work at night say 50%	1	LS	1,132,728	1,132,728
148					
149					
150	**PREMIUM ASSOCIATED WITH PSD's**				**4,908,488**

Table of Contents Appendix Table of Contents

STATION: LEXINGTON AVE - 63RD ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	615	LF		
5	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	615	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,230**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,230	LF	7	8,610
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,150	SF	12	73,800
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,232	EA	25	30,800
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,232	EA	25	30,800
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,230	LF	95	116,850
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,230	LF	15	18,450
26	Remove existing platform tiles	1,230	LF	12	14,760
27	Sawcut existing topping concrete at perimeter of removal area	1,230	LF	5	6,150
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,380	SF	8	59,040
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Platform width i.e. 21'-6" wide strip at ADA boarding area	418	SF	8	3,344
30	New Work				
31	New concrete topping to match existing	1,230	SF	15	18,450
32	New concrete topping at ADA boarding area to match existing	418	SF	15	6,270

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: LEXINGTON AVE - 63RD ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [12'-0" x 16'-0"]**				
37	Build off existing Mezzanine Slab; 3 Walls only		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	56	LF	90	5,040
39	CMU Wall for equipment room	560	SF	45	25,200
40	Vertical connections with existing structure	-	LF	25	-
41	Fire rated door including frame & hardware	1	EA	2,500	2,500
42	Exterior wall finish				
43	Ceramic Tiling to match existing	560	SF	40	22,400
44	Mosaic Band to match existing - Assuming 8" high	56	LF	120	6,720
45	Concrete cove to match existing	56	LF	20	1,120
46	Interior Wall Finish - Paint	560	SF	5	2,800
47	Allow for Misc. floor & ceiling finishes	192	SF	15	2,880
48	Allow for 4" thick concrete pads for equipment	48	SF	20	960
49	Allowance for Mechanical Scope	1	LS	40,000	40,000
50	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
51	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
52	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54	**Automatic Platform Gates [APGs] - 4'-6" High**				
55	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
56	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
57	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
58	Platform End Gates (PEGs)	4	EA	13,000	52,000
59	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
60	Spare Parts - Approx. 10% of Material Cost	1	LS	227,910	227,910
61	Testing and commissioning	800	HRS	160	127,944
62	Product Warranty	1	LS	1,000,000	1,000,000
63	Allowance for Braille Signage	80	EA	2,500	200,000
64					
65	**Electrical**				
66	Electrical Upgrades				
67	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
68	Power and Lighting				
69	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
70	Allow for conduit / cable runs for power and communications under platform edge	1,230	LF	60	73,800
	PSD Connections	1	LS	75,000	75,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: LEXINGTON AVE - 63RD ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
72	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
73	Power to PSD Room from EDR including track crossing if needed	750	LF	60	45,000
74	Reserve power to PSD Room from EDR including track crossing if needed	750	LF	60	45,000
75	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
76	Grounding				
77	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
78	MISC				
79	Testing and commissioning	1	LS	30,000	30,000
80	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
81					
82	**Communications**				
83	FA System				
84	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
85	CCTV coverage				
86	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
87	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
88	Berthing Technology Sensors				
89	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
90	Train Door Detection System				
91	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
92	Entrapment concerns				
93	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
94	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
95	Engineering and Testing	2,000	Hrs	160	319,860
96	Centralized monitoring/control				
97	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
98	MISC				
99	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
100	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
101	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: LEXINGTON AVE - 63RD ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
102	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
103	Furnish Test Equipment allowance	1	LS	500,000	500,000
104	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
105					
106	**Training**				
107	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
108					
109	**Out of hours Work**				
110	Allow loss of production to work at night say 50%	1	LS	3,861,237	3,861,237
112	TOTAL PSD WORK:				$ 16,732,028

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
114					
115	ADD ALTERNATIVE				
116					
117	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
118					
119	ADD				
120	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
121	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
122	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
123	Platform End Gates (PEGs)	4	EA	18,000	72,000
124	Fixed Panels including framing and support; Assuming 8'-0" high	4,974	SF	750	3,730,365
125	Spare Parts - Approx. 10% of Material Cost	1	LS	421,942	421,942
126	Structual framing / bracing				
127	HSS4x4x1/2 hanger	5	TONS	17,500	81,657
128	L6x6x1/2 continuous angle	9	TONS	17,500	158,424
129	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
130	Platform Edge Repair - **Not Required**				
131	Remove concrete platform edge	-	LF	27	-
132	Platform edge repair	-	LF	109	-
133	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	-	EA	10	-
134					
135	OMIT				
136	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
137	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
138	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
139	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
140	Fixed Panels including framing and support; 4'-6" High	(2,250)	SF	750	(1,687,500)
141	Spare Parts - Approx. 10% of Material Cost	(1)	LS	227,910	(227,910)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: LEXINGTON AVE - 63RD ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Platform Edge Reconstruction work	(1)	LS	560,600	(560,600)
143	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
144	Conduit running under Platform Edge	(1,230)	LF	30	(36,900)
145					
146	Allow loss of production to work at night say 50%	1	LS	936,758	936,758
147					
148	**PREMIUM ASSOCIATED WITH PSD's**				**4,059,284**

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: YORK ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	660	LF		
5	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,320**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Platform width i.e. 20'-0" wide strip at ADA boarding area	352	SF	8	2,816
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800
32	New concrete topping at ADA boarding area to match existing	352	SF	15	5,280

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: YORK ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [12'-0" x 16'-0"]**				
37	Build off existing Paid Area Slab; 3 Walls only		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	44	LF	90	3,960
39	CMU Wall for equipment room	440	SF	45	19,800
40	Vertical connections with existing structure	20	LF	25	500
41	Fire rated door including frame & hardware	1	EA	2,500	2,500
42	Exterior wall finish				
43	Ceramic Tiling to match existing	440	SF	40	17,600
44	Mosaic Band to match existing - Assuming 8" high	44	LF	120	5,280
45	Concrete cove to match existing	44	LF	20	880
46	Interior Wall Finish - Paint	440	SF	5	2,200
47	Allow for Misc. floor & ceiling finishes	192	SF	15	2,880
48	Allow for 4" thick concrete pads for equipment	48	SF	20	960
49	Allowance for Mechanical Scope	1	LS	40,000	40,000
50	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
51	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
52	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
53					
54	**Automatic Platform Gates [APGs] - 4'-6" High**				
55	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
56	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
57	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
58	Platform End Gates (PEGs)	4	EA	13,000	52,000
59	Fixed Panels including framing and support; 4'-6" High	2,655	SF	750	1,991,250
60	Spare Parts - Approx. 10% of Material Cost	1	LS	246,135	246,135
61	Testing and commissioning	800	HRS	160	127,944
62	Product Warranty	1	LS	1,000,000	1,000,000
63	Allowance for Braille Signage	80	EA	2,500	200,000
64					
65	**Electrical**				
66	Electrical Upgrades				
67	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
68	Power and Lighting				
69	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
70	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: YORK ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
	PSD Connections	1	LS	75,000	75,000
72	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
73	Power to PSD Room from EDR including track crossing if needed	950	LF	60	57,000
74	Reserve power to PSD Room from EDR including track crossing if needed	1,000	LF	60	60,000
75	No allowance for new lighting as if APG's are used		Note		EXCL.
76	Grounding				
77	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
78	MISC				
79	Testing and commissioning	1	LS	30,000	30,000
80	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
81					
82	**Communications**				
83	FA System				
84	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
85	CCTV coverage				
86	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
87	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
88	Berthing Technology Sensors				
89	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
90	Train Door Detection System				
91	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
92	Entrapment concerns				
93	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
94	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
95	Engineering and Testing	2,000	Hrs	160	319,860
96	Centralized monitoring/control				
97	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
98	MISC				
99	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
100	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
101	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: YORK ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
103	Furnish Test Equipment allowance	1	LS	500,000	500,000
104	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
105					
106	**Training**				
107	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
108					
109	**Out of hours Work**				
110	Allow loss of production to work at night say 50%	1	LS	3,978,215	3,978,215
112	TOTAL PSD WORK:				$ 17,238,933

114					
115	ADD ALTERNATIVE				
116					
117	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
118					
119	ADD				
120	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
121	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
122	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
123	Platform End Gates (PEGs)	4	EA	18,000	72,000
124	Fixed Panels including framing and support; Assuming 8'-0" high	5,694	SF	750	4,270,365
125	Spare Parts - Approx. 10% of Material Cost	1	LS	454,342	454,342
126	Structual framing / bracing				
127	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
128	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
129	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
130	Platform Edge Repair				
131	Remove concrete platform edge	1,320	LF	27	35,640
132	Platform edge repair	1,320	LF	109	143,880
133	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	656	EA	10	6,560
134					
135	OMIT				
136	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
137	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
138	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
139	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
140	Fixed Panels including framing and support; 4'-6" High	(2,655)	SF	750	(1,991,250)
141	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,135	(246,135)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: YORK ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Platform Edge Reconstruction work	(1)	LS	593,000	(593,000)
143	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
144	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
145					
146	Allow loss of production to work at night say 50%	1	LS	1,062,421	1,062,421
147					
148	**PREMIUM ASSOCIATED WITH PSD's**				**4,603,823**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: STILLWELL AVE - CONEY ISLAND

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [TRACK 5] =	640	LF		
5	LENGTH OF THE PLATFORM EDGE [TRACK 6] =	640	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,280**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,280	LF	7	8,960
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,400	SF	12	76,800
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	129	CY	2,500	322,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,282	EA	25	32,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,282	EA	25	32,050
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,280	LF	95	121,600
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,280	LF	15	19,200
26	Remove existing platform tiles	1,280	LF	12	15,360
27	Sawcut existing topping concrete at perimeter of removal area	1,280	LF	5	6,400
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,680	SF	8	61,440
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Platform width i.e. 27'-0" wide strip at ADA boarding area	660	SF	8	5,280
30	New Work				
31	New concrete topping to match existing	1,280	SF	15	19,200
32	New concrete topping at ADA boarding area to match existing	660	SF	15	9,900

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: STILLWELL AVE - CONEY ISLAND

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [12'-0" x 16'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	56	LF	90	5,040
39	CMU Wall for equipment room	560	SF	45	25,200
40	Vertical connections with existing structure	-	LF	25	-
41	Roof				-
42	Structural Steel Roof Framing; say 15 lbs / sf	2	TONS	17,500	35,000
43	New standing seam roof sheeting	192	SF	38	
44	Roof gutters and down spout	16	LF	40	640
45	Powder Coated Aluminum Parapet Flashing	56	LF	45	2,520
46	Fire rated door including frame & hardware	1	EA	2,500	2,500
47	Exterior wall finish				-
48	Metal cladding to exterior	560	SF	50	28,000
49	Interior Wall Finish - Paint	560	SF	5	2,800
50	Allow for Misc. floor & ceiling finishes	192	SF	15	2,880
51	Allow for 4" thick concrete pads for equipment	48	SF	20	960
52	Allowance for Mechanical Scope	1	LS	40,000	40,000
53	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
54	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
55	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
56					
57	**Automatic Platform Gates [APGs] - 4'-6" High**				
58	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
59	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
60	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
61	Platform End Gates (PEGs)	4	EA	13,000	52,000
62	Fixed Panels including framing and support; 4'-6" High	2,475	SF	750	1,856,250
63	Spare Parts - Approx. 10% of Material Cost	1	LS	238,035	238,035
64	Testing and commissioning	800	HRS	160	127,944
65	Product Warranty	1	LS	1,000,000	1,000,000
66	Allowance for Braille Signage	80	EA	2,500	200,000
67					
68	**Electrical**				
69	Electrical Upgrades				
70	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
71	Power and Lighting				
72	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: STILLWELL AVE - CONEY ISLAND

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
73	Allow for conduit / cable runs for power and communications under platform edge	1,280	LF	60	76,800
	PSD Connections	1	LS	75,000	75,000
75	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
76	Power to PSD Rooms from EDR [Conduit & Cable]	750	LF	60	45,000
77	Reserve power to PSD Room from EDR [Conduit & Cable]	750	LF	60	45,000
78	No allowance for new lighting as if APG's are used		Note		EXCL.
79	Grounding				
80	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
81	MISC				
82	Testing and commissioning	1	LS	30,000	30,000
83	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
84					
85	**Communications**				
86	FA System				
87	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
88	CCTV coverage				
89	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
90	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
91	Berthing Technology Sensors				
92	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
93	Train Door Detection System				
94	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
95	Entrapment concerns				
96	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
97	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
98	Engineering and Testing	2,000	Hrs	160	319,860
99	Centralized monitoring/control				
100	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
101	MISC				
102	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
103	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
104	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: STILLWELL AVE - CONEY ISLAND

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
105	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
106	Furnish Test Equipment allowance	1	LS	500,000	500,000
107	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
108					
109	**Training**				
110	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
111					
112	**Out of hours Work**				
113	Allow loss of production to work at night say 50%	1	LS	3,936,601	3,936,601
115	TOTAL PSD WORK:				$ 17,058,603

117					
118	**ADD ALTERNATIVE**				
119					
120	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
121					
122	**ADD**				
123	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
124	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
125	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
126	Platform End Gates (PEGs)	4	EA	18,000	72,000
127	Fixed Panels including framing and support; Assuming 8'-0" high	5,374	SF	750	4,030,365
128	Spare Parts - Approx. 10% of Material Cost	1	LS	439,942	439,942
129	Structual framing / bracing				
130	HSS4x4x1/2 hanger	5	TONS	17,500	84,923
131	L6x6x1/2 continuous angle	9	TONS	17,500	164,864
132	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
133	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long	1	LS	350,000	350,000
134	Platform Edge Repair - **Not Required**				
135	Remove concrete platform edge	-	LF	27	-
136	Platform edge repair	-	LF	109	-
137	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	-	EA	10	-
138					
139	**OMIT**				
140	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
141	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
142	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
143	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for F Line Stations

4-Oct-18

STATION: STILLWELL AVE - CONEY ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144	Fixed Panels including framing and support; 4'-6" High	(2,475)	SF	750	(1,856,250)
145	Spare Parts - Approx. 10% of Material Cost	(1)	LS	238,035	(238,035)
146	Platform Edge Reconstruction work	(1)	LS	578,600	(578,600)
147	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
148	Conduit running under Platform Edge	(1,280)	LF	30	(38,400)
149					
150	Allow loss of production to work at night say 50%	1	LS	1,080,557	1,080,557
151					
152					
153	**PREMIUM ASSOCIATED WITH PSD's**				**4,682,415**

New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR ‘M’ LINE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

FINAL SUBMITTAL DATE: December 5, 2018

Table of Contents

0.0 Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 36 newly evaluated stations, 32 have been found to be not suitable for the installation of PSDs.

[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to low-height barriers]

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues; the PSD platform edge barriers are 15" wide. Where an existing object (wall, stair, and railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Where these PSDs hamper the ability of a wheelchair to turn (a 5'-0" circle) and/or limit path of travel to less than 32" pinch width, it is declared infeasible. This requirement dictates that if a column or any obstruction measuring less than or equal to 24" in the direction of circulation is present, it may not constrain the circulation path to less than 32".
- Insufficient space for the PSD equipment room; the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow; due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements in regard to the placement of these new barriers in an existing station environment.
- Structural considerations; existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.

- Car door misalignment (part of Tier 1 selection process): Presently (2018) the NYCT system features three car geometries on the A Division and three car geometries on the B Division. With few exceptions, these cars are freely mixed between lines. The spacing of doors on these differing cars is significantly misaligned, making the installation of platform doors infeasible. Looking to the future, NYCT plans to procure new rolling stock with identical or nearly identical door spacing. The current procurement schedule indicates the purchase of these geometrically compatible cars by 2032. Therefore, our assessment of feasibility is based on the year 2032.

  However, the M line service and several overlapping services on the B Division will remain incompatible even after 2032. The M is an eight-car train, whereas the E, F, R lines are ten-car trains. The newer trains are assembled in two consists, with a driver / conductor cabin at the front and back of each consist. Due to the cabin, the spacing of doors on the first and last car differs from the door spacing of the other cars of the train. Therefore, there will inevitably be a mismatching of doors as these two differing train types berth at a certain station platform. The M train cannot be extended to a ten-car length because all the station stops in Brooklyn feature station platforms of an eight-car length. Please see the diagrams in Figure 1 below.

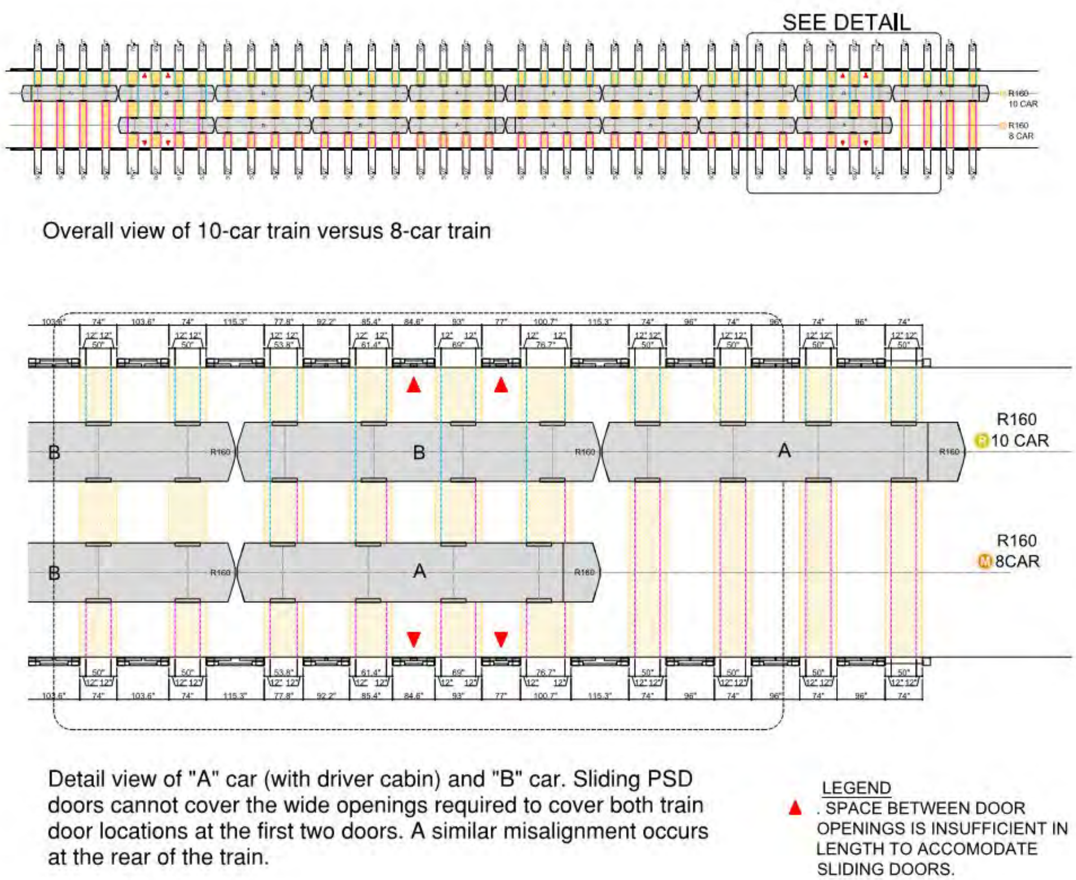

***Figure 1** – Ten-car vs. eight-car train Comparison of door geometry*

Note that a determination full feasibility will require two additional steps

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the previously proposed 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the PSD barriers and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 11% of the 'M' Line stations. Total implementation cost would be $111.5M for APGs and $138.9M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; That estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of $931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 4 feasible stations, the aggregate annual maintenance cost would be $3.7M.

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Summary Table

M' Line Summary of Feasibility				(11% feasible; 4/36)			
MRN	Station Name	Station Type	Platform Type	Feasible Yes / No	Issues / Reason for Failure	Cost APGs	Cost PSDs
97	Myrtle Avenue - Broadway	ELV	Side	No	ADA Clearance		
98	Flushing Avenue	ELV	Side	No	ADA Clearance		
99	Lorimer Street	ELV	Side	No	ADA Clearance		
100	Hewes Street	ELV	Side	No	ADA Clearance		
101	Marcy Avenue	ELV	Side	No	Precast Platform		
108	Middle Village Metropolitan Ave	EMB	Center/Island	Yes		$28.9 M	$36.0 M
109	Fresh Pond Road	ELV	Center/Island	Yes		$27.3 M	$34.0 M
110	Forest Avenue	ELV	Center/Island	Yes		$27.3 M	$33.9 M
111	Seneca Ave. Palmetto St.	ELV	Center/Island	No	ADA Clearance		
112	Myrtle / Wyckoff Ave	ELV	Center Island	Yes		$28.0 M	$35.0 M
113	Knickerbocker Avenue	ELV	Side	No	ADA Clearance		
114	Central Ave	ELV	Side	No	ADA Clearance		
167	West 4th St.	SUB	Center/Island	No	Tier 1 Failure – Train Door Misalignment		
225	47th 50th Street Rockefeller	SUB	Center/Island	No	Tier 1 Failure – Train Door Misalignment		
226	42nd Street Bryant Park	SUB	Center/Island	No	Tier 1 Failure – Train Door Misalignment		
227	34th Street Herald Sq.	SUB	Center/Island	No	Tier 1 Failure – Train Door Misalignment		
228	23rd Street	SUB	Side	No	Tier 1 Failure – Train Door Misalignment		
229	14th Street	SUB	Side	No	Tier 1 Failure – Train Door Misalignment		
230	Broadway/Lafayette St.	SUB	Center/Island	No	Tier 1 Failure – Train Door Misalignment		
233	Delancey St. Essex St.	SUB	Side	No	ADA Clearance		
261	71st Avenue Forest Hills	SUB	Center/Island	No	Tier 1 Failure – Train Door Misalignment		
262	67th Avenue	SUB	Side	No	Tier 1 Failure – Train Door Misalignment		
263	63rd Drive Rego Pk	SUB	Side	No	Tier 1 Failure – Train Door Misalignment		
264	Woodhaven Blvd.	SUB	Side	No	Tier 1 Failure – Train Door Misalignment		
265	Grand Avenue Newtown	SUB	Side	No	Tier 1 Failure – Train Door Misalignment		
266	Elmhurst Avenue	SUB	Side	No	Tier 1 Failure – Train Door Misalignment		
267	Jackson Hts. 74th St. Roosevelt.	SUB	Center/Island	No	Tier 1 Failure – Train Door Misalignment		
268	65th Street	SUB	Side	No	Tier 1 Failure – Train Door Misalignment		
269	Northern Blvd.	SUB	Side	No	Tier 1 Failure – Train Door Misalignment		
270	46th Street	SUB	Side	No	Tier 1 Failure – Train Door Misalignment		
271	Steinway Street	SUB	Side	No	Tier 1 Failure – Train Door Misalignment		
272	36th Street	SUB	Side	No	Tier 1 Failure – Train Door Misalignment		
273	Queens Plaza	SUB	Center/Island	No	Tier 1 Failure – Train Door Misalignment		
274	Court Sq. 23rd St. / Ely.	SUB	Side	No	Tier 1 Failure – Train Door Misalignment		
275	Lexington Avenue 53rd St.	SUB	Center/Island	No	Tier 1 Failure – Train Door Misalignment		
276	5th Avenue – 53rd Street	SUB	Side	No	Tier 1 Failure – Train Door Misalignment		
					TOTAL COST	$111.5 M	$138.9 M

1.0 Station Assessments

1.01 – MRN 097 | Myrtle Avenue-Broadway Station

Summary: *Myrtle Avenue-Broadway Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 31" (see figure 1).*

Description

Myrtle Avenue-Broadway Station is an elevated station with two straight center / island platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 14'-0" throughout. There are three staircases on each of the platforms. Columns are spaced 15'-4" on center and flank the staircases on both sides. Currently the stair barrier and columns measure 46" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 31" would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

Figure 1 *– Non-Compliant ADA condition*
Myrtle Avenue-Broadway Station

1.02 – MRN 098 | Flushing Avenue Station

Summary: *Flushing Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1).*

Description

Flushing Avenue Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 9'-2" throughout. There are two staircases along each of the platforms located at 40" from the platform edge. With the implementation of a platform edge barrier this width would be reduced to 25", which is not compliant with the ADA minimum of 36". See figure 1 below.

Figure 1 *– Non-Compliant ADA condition*
Flushing Avenue Station

1.03 – MRN 099 | Lorimer Street Station

Summary: *Lorimer Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1).*

Description

Lorimer Street Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 9'-4" throughout. There are two staircases along each of the platforms located at 40" from the platform edge. With the implementation of a platform edge barrier this width would be reduced to 25", which is not compliant with the ADA minimum of 36". See figure 1 below.

***Figure 1** – Non-Compliant ADA condition*
Lorimer Street Station

1.04 – MRN 100 | Hewes Street Station

Summary: *Hewes Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1).*

Description

Hewes Street Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 9'-8" throughout. There are two staircases along each of the platforms located at 40" from the platform edge. With the implementation of a platform edge barrier this width would be reduced to 25", which is not compliant with the ADA minimum of 36". See figure 1 below.

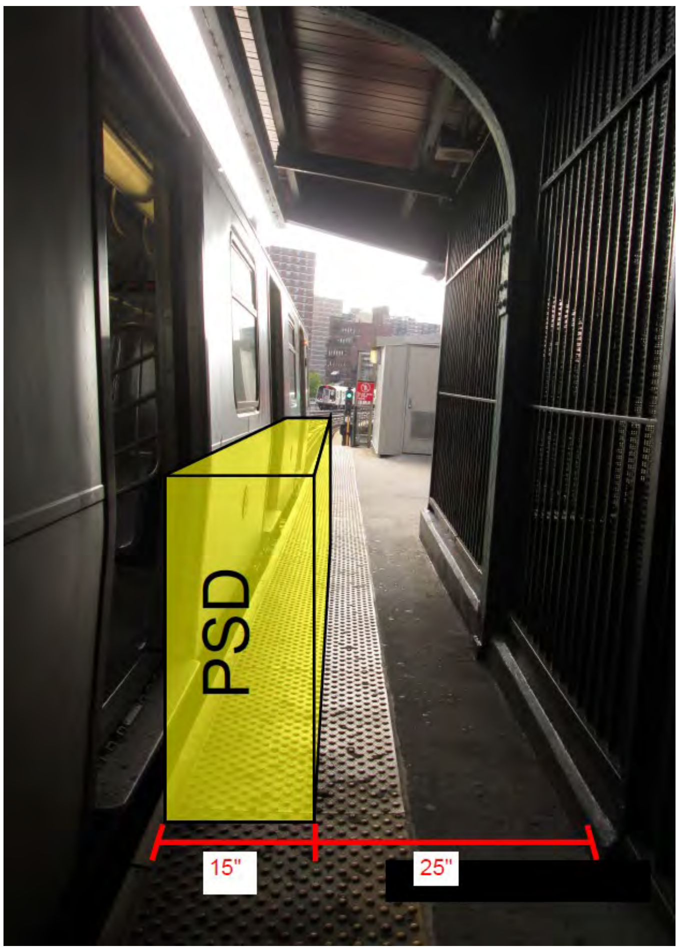

Figure 1 *– Non-Compliant ADA condition*
Hewes Street Station

1.05 – MRN 101 | Marcy Avenue Station

Summary: *Marcy Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2).*

Description

Marcy Avenue Station is an elevated station consisting of two side platforms. The platform widths are approximately 10'-0". The platforms are straight with a row of a columns in line with the wind screen, which support the station canopy. The canopy covers half of the platform length. See figure 1 & 2 for reference.

Figure 1 *– General Station condition*
Marcy Avenue Station

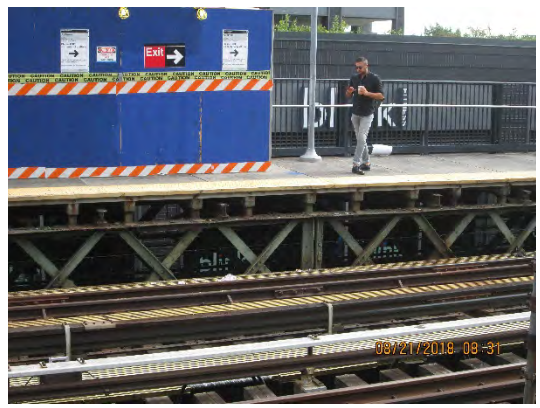

Figure 2 *– Precast Slab*
Marcy Avenue Station

1.06 – MRN 108 | Middle Village Metropolitan Avenue Station

Summary: *Middle Village Metropolitan Avenue Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see structural report; Appendix B). Existing power is adequate.*

Description

Middle Village Metropolitan Avenue Station is an embankment station with one center / island platform **(see Figure 1)**. The platform structure is cast-in-place concrete. Columns are centered throughout the length of the platform and are spaced 30'-0 apart on center. Column faces measure approximately 6'-1" from the platform edge. The platform width is approximately 13'-6" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the south end of the station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-0" x 6'-6".

Track Layout

Tracks are nearly tangent. We are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, structural work would only be required for the installation of an APG system. The 2012 NYCT conditions survey information was not ascertainable at the time of drafting this report, where on a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair. Any platform edge with a rating above 2.5 requires platform rehabilitation regardless of if an APG or PSD system is utilized.

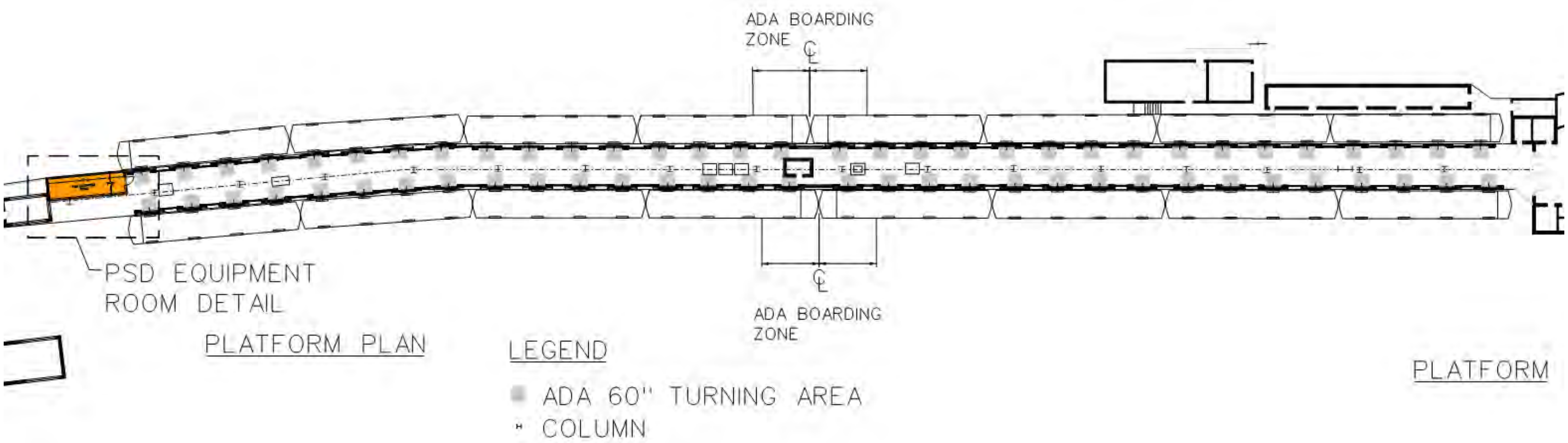

***Figure 1** – Overall Station Plan*
Middle Village Metropolitan Avenue Station

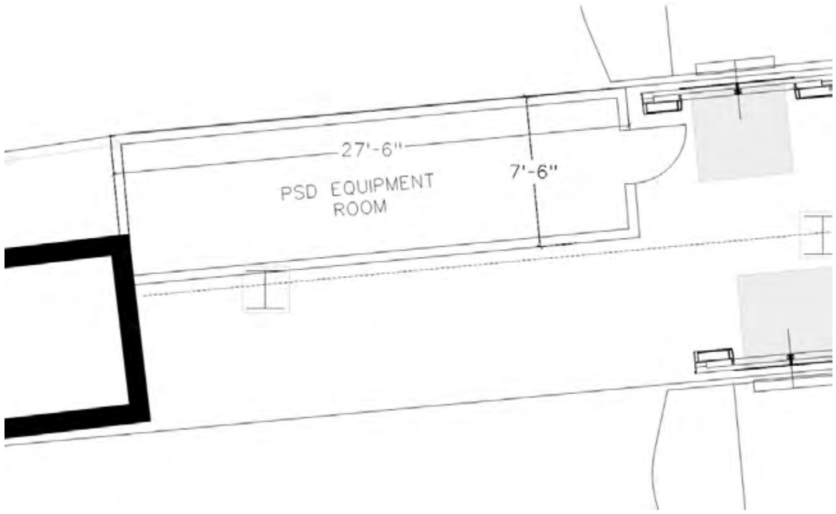

Figure 2 *– PSD Equipment Room 1 Detail*
Middle Village Metropolitan Avenue Station

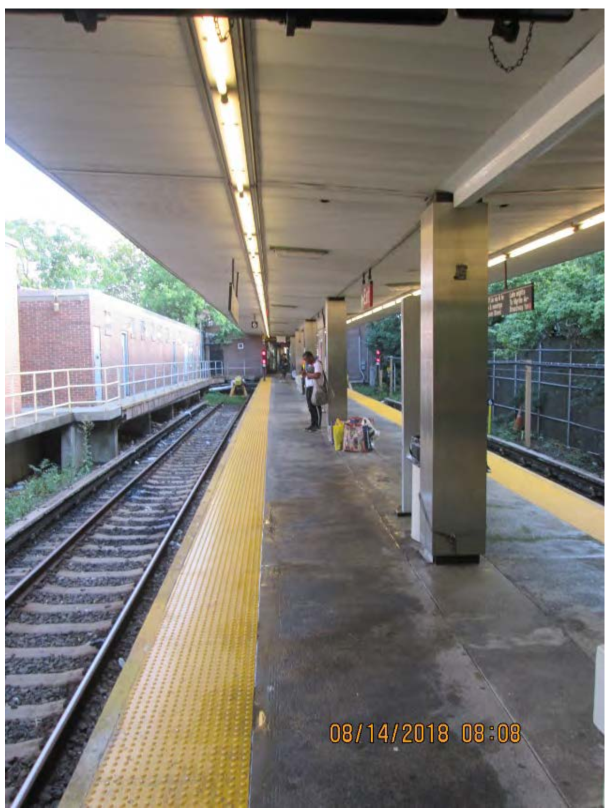

Figure 3 *– Typical platform view*
Middle Village Metropolitan Avenue Station

Platform obstructions within 5' of edge: None

Lighting:
Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Installation of APG/PSD will not affect the existing lighting configuration.

Power:
This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 & Table 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis

Station Name	Middle Village Metropolitan Ave
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	79.2
Apparent Power (kVA)	99.0
Station Peak Demand Load, Max Current, (A)	275.0
Maximum Amount of Doors	64.0
PSD Total Load Including All Miscellaneous Loads, (A)	165.4
Total Load (Station Peak + PSD), (A)	440
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	360
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram. Station has (2) separate meter readings, for each Normal & Reserve service. This analysis is for **Normal service**.

Table 1. *Normal Service Power Capacity Analysis*

Station
Power Capacity Analysis

Station Name	Middle Village Metropolitan Ave
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	37.2
Apparent Power (kVA)	46.5
Station Peak Demand Load, Max Current, (A)	129.2
Maximum Amount of Doors	64.0
PSD Total Load Including All Miscellaneous Loads, (A)	165.4
Total Load (Station Peak + PSD), (A)	295
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	505
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram. Station has (2) separate meter readings, for each Normal & Reserve service. This analysis is for **Reserve service**.

***Table 2**. Reserve Service Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $28.9M to install APGs and $36.0M to install PSDs (See Appendix E)

1.07 – MRN 109 | Fresh Pond Road Station

Summary: *Fresh Pond Road Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see structural report; Appendix B). Existing power is adequate.*

Description

Fresh Pond Road Station is an elevated station with one center / island platform **(see Figure 1)**. The platform structure is cast-in-place concrete. Columns are located throughout the length of the canopy in two rows and are spaced approximately 22'-0" apart on center. The canopy covers approximately 2/3 of the platform length. Column faces measure approximately 4'-0" from the platform edge. The platform width is approximately 26'-0" throughout except for a taper at the south end where the platform measures 17'-0". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. The installation of full height PSDs beyond the canopy will require an overhead support structure.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. At parts of the platform not covered by a canopy, minimal overhead structures would be required to support cameras and sensors.

Equipment Room

The equipment room can be located at the north end of the station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-0" x 6'-6".

Track Layout

Tracks are nearly tangent. We are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

This platform edge was re-constructed within the last five years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system.

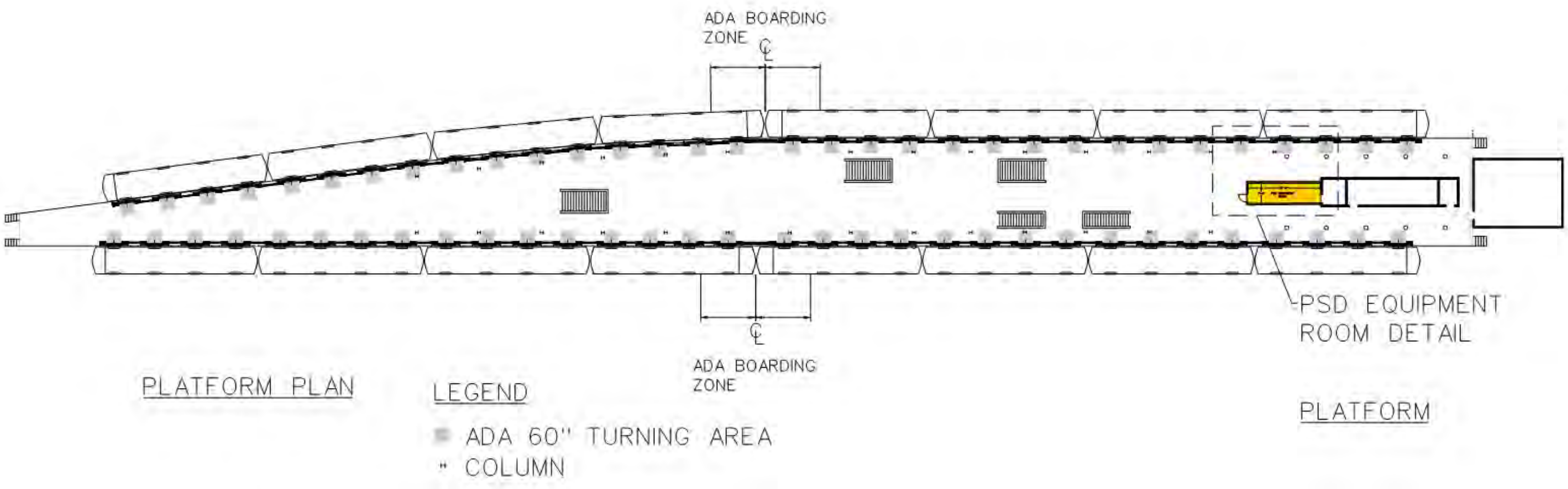

***Figure 1** – Overall Station Plan*
Fresh Pond Road Station

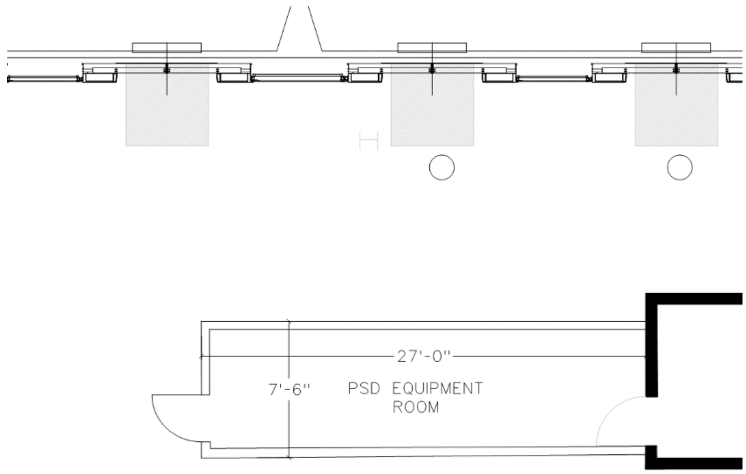

Figure 2 *– PSD Equipment Room 1 Detail*
Fresh Pond Road Station

Figure 3 *– Typical platform view*
Fresh Pond Road Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing columns which obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Installation of APG/PSD will not affect the existing lighting configuration.

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 & Table 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Fresh Pond Road
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	44.8
Apparent Power (kVA)	56.0
Station Peak Demand Load, Max Current, (A)	155.5
Maximum Amount of Doors	64.0
PSD Total Load Including All Miscellaneous Loads, (A)	165.4
Total Load (Station Peak + PSD), (A)	321
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	479
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram. Station has (2) separate meter readings, for each Normal & Reserve service. This analysis is for **Normal service**.

Table 1. *Normal Service Power Capacity Analysis*

Station
Power Capacity Analysis

NYCT Station MR Number	109
Station Name	Fresh Pond Road
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	9.6
Apparent Power (kVA)	12.0
Station Peak Demand Load, Max Current, (A)	33.3
Maximum Amount of Doors	64.0
PSD Total Load Including All Miscellaneous Loads, (A)	165.4
Total Load (Station Peak + PSD), (A)	199
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	601
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram. Station has (2) separate meter readings, for each Normal & Reserve service. This analysis is for **Reserve service**.

Table 2. Reserve Service Power Capacity Analysis

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.3M to install APGs and $34.0M to install PSDs (See Appendix E)

1.08 – MRN 110 | Forest Avenue Station

Summary: *Forest Avenue 67th Avenue Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see structural report; Appendix B). Existing power is adequate.*

Description

Forest Avenue Station is an elevated station with one center / island platform **(see Figure 1)**. The platform structure is cast-in-place concrete. Columns are located throughout the length of the platform in two rows and are spaced approximately 25'-0" apart on center. Column faces measure approximately 2'-6" from the platform edge. The platform width is approximately 19'-0" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. The installation of full height PSDs beyond the canopy will require an overhead support structure.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. At parts of the platform not covered by a canopy, minimal overhead structures would be required to support cameras and sensors.

Equipment Room

The equipment room can be located at the north end of the station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-0" x 6'-6".

Track Layout

Tracks are tangent. We are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

This platform edge was re-constructed within the last five years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system.

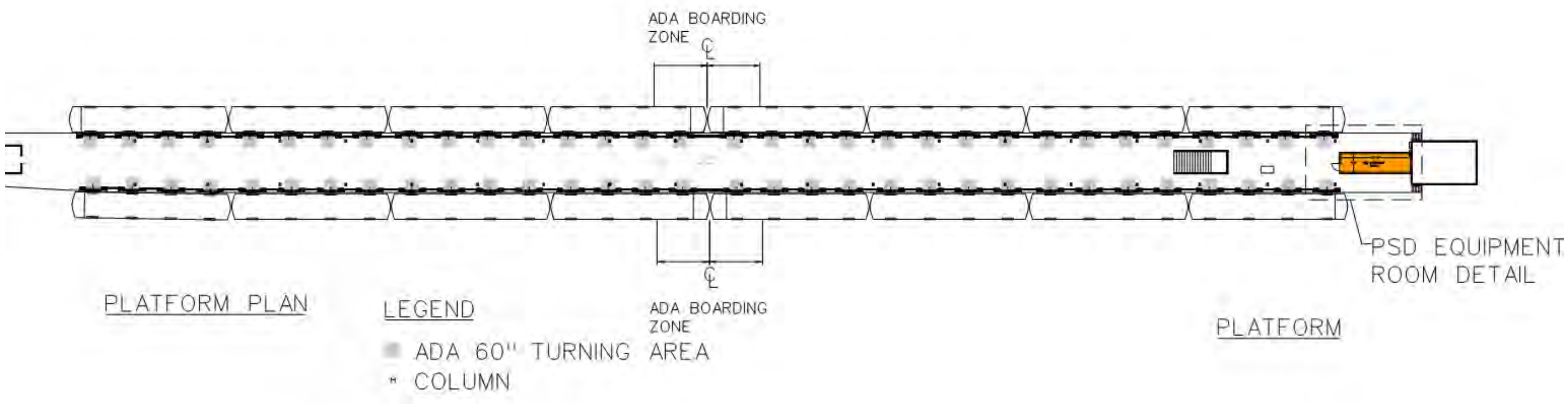

Figure 1 – *Overall Station Plan*
Forest Avenue Station

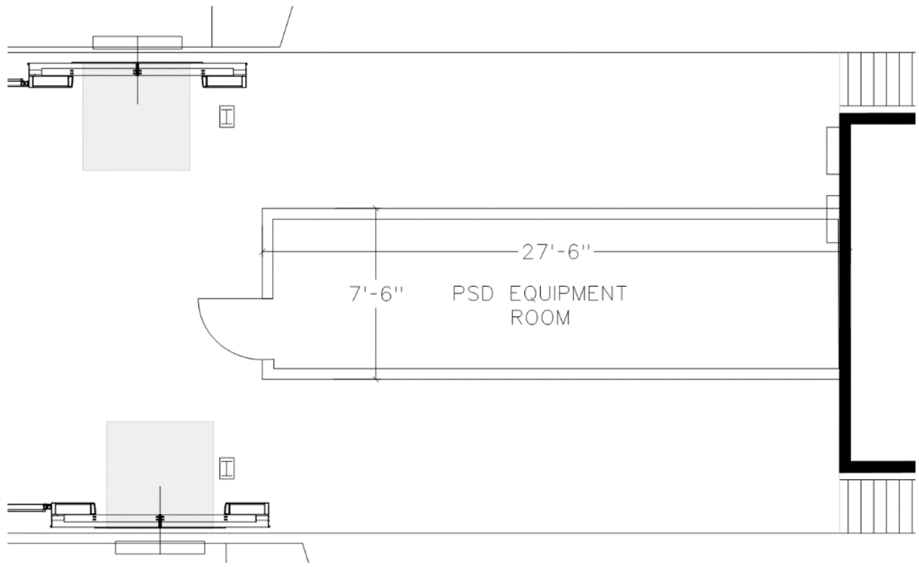

Figure 2 *– PSD Equipment Room 1 Detail*
Forest Avenue Station

Figure 3 *– Typical platform view*
Forest Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing columns which obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Installation of APG/PSD will not affect the existing lighting configuration.

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 & Table 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Forest Avenue 67th Ave
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	24.0
Apparent Power (kVA)	30.0
Station Peak Demand Load, Max Current, (A)	83.3
Maximum Amount of Doors	64.0
PSD Total Load Including All Miscellaneous Loads, (A)	165.4
Total Load (Station Peak + PSD), (A)	249
Station Service Power Capacity, (Main SB or SG Rating), (A)	400
Service Spare Capacity, (A)	151
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 400A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. This analysis is for **Normal service**.

Table 1. *Normal Service Power Capacity Analysis*

Station
Power Capacity Analysis

Station Name	Forest Avenue 67th Ave
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	6.0
Apparent Power (kVA)	7.5
Station Peak Demand Load, Max Current, (A)	20.8
Maximum Amount of Doors	64.0
PSD Total Load Including All Miscellaneous Loads, (A)	165.4
Total Load (Station Peak + PSD), (A)	185
Station Service Power Capacity, (Main SB or SG Rating), (A)	400
Service Spare Capacity, (A)	215
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 400A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. This analysis is for **Reserve service**.

Table 2. *Reserve Service Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.3M to install APGs and $33.9M to install PSDs (See Appendix E)

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1.09 – MRN 111 | Seneca Avenue Station

Summary: *Seneca Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 17" (see figure 1).*

Description

Seneca Avenue Station an elevated station with one straight center / island platform. The platform structure is cast-in-place concrete. The width of the platforms is approximately 15'-0" throughout. There are two staircases on the platform, located a minimum of 32" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 17" would not allow for ADA compliant wheelchair movement nor normal passenger movement. See figure 1 for reference.

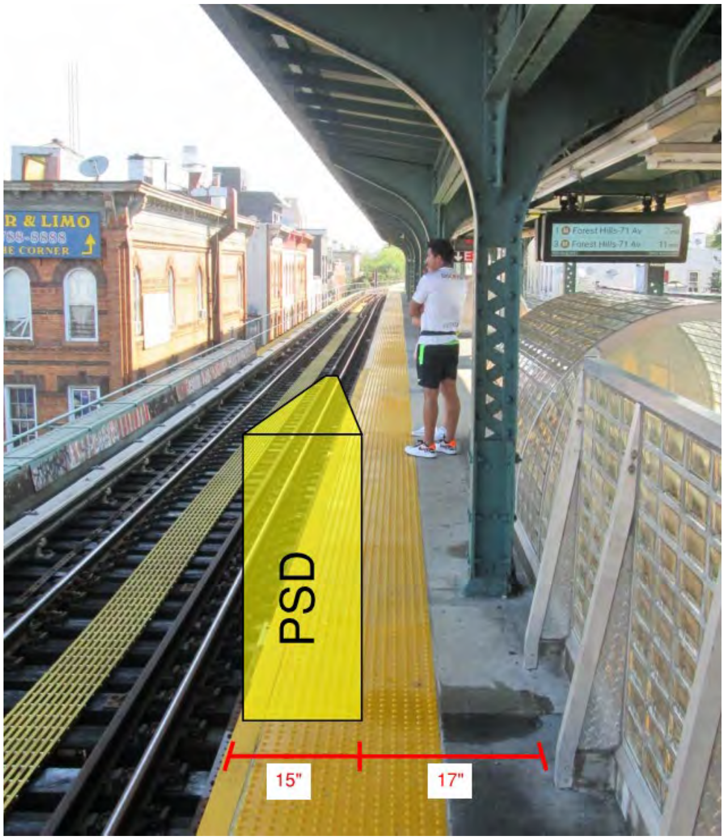

Figure 1 *– Non-Compliant ADA condition*
Seneca Avenue Station

1.10 – MRN 112 | Myrtle/Wyckoff Avenue Station

Summary: *Myrtle/Wyckoff Avenue Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG system (see structural report; Appendix B). Information regarding electrical capacity was not ascertainable at the time of the survey. However, we do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.*

Description

Myrtle/Wyckoff Avenue Station is an elevated station with one center / island platform **(see Figure 1)**. The platform structure is cast-in-place concrete. Columns are located throughout the length of the platform in four rows and are spaced approximately 20'-0" apart on center. Column faces measure approximately 2'-6" from the platform edge. The platform width is approximately 15'-0" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. The installation of full height PSDs beyond the canopy will require an overhead support structure.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. At parts of the platform not covered by a canopy, minimal overhead structures would be required to support cameras and sensors.

Equipment Room

The equipment room can be located at the west end of the station (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-0" x 6'-6".

Track Layout

Tracks are tangent. We are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

This platform edge was re-constructed within the last ten years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system.

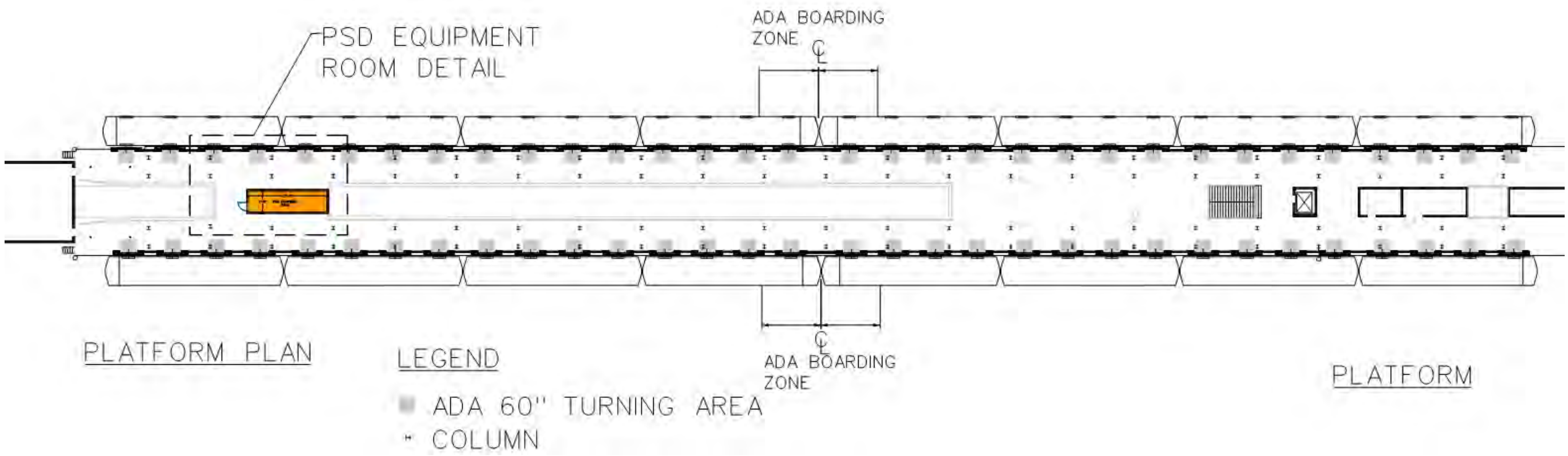

Figure 1 – Overall Station Plan
Myrtle/Wyckoff Avenue Station

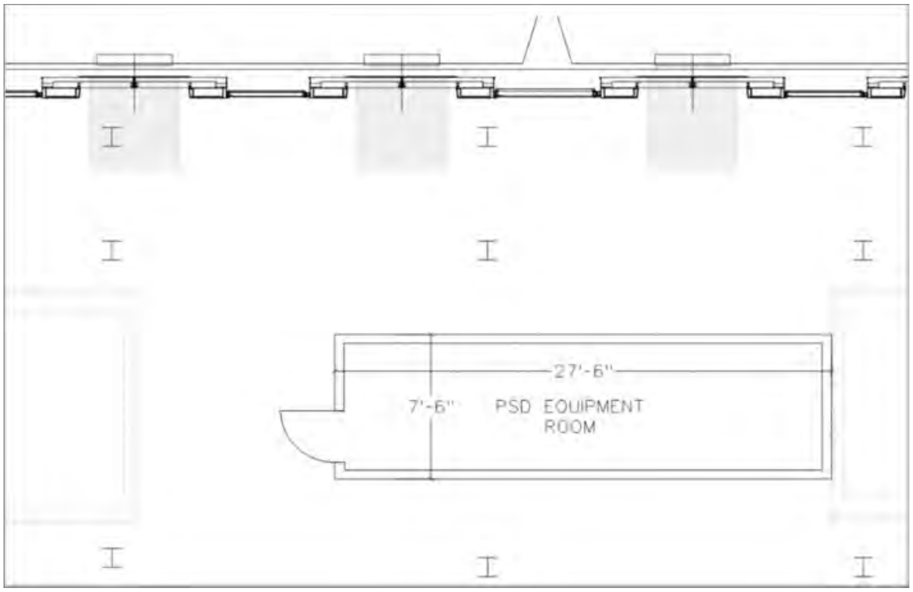

Figure 2 *– PSD Equipment Room 1 Detail*
Myrtle/Wyckoff Avenue Station

Figure 3 *– Typical platform view*
Myrtle/Wyckoff Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; perpendicular to the platform edge. Installation of APG/PSD will not affect the existing lighting configuration.

Power:

This information was not ascertainable at the time of the survey. However, we do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $28.0M to install APGs and $35.0M to install PSDs (See Appendix E)

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1.11 – MRN 113 | Knickerbocker Station

Summary: *Knickerbocker Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 17" (see figure 1).*

Description

Knickerbocker Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 9'-0" throughout. There is one staircase along each of the platforms located at 34" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 17" would not allow for ADA compliant wheelchair movement nor normal passenger movement. See figure 1 below.

Figure 1 *– Non-Compliant ADA condition*
Knickerbocker Avenue Station

1.12 – MRN 114 | Central Avenue Station

Summary: *Central Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 19" (see figure 1).*

Description

Central Avenue Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 9'-0" throughout. There is one staircase along each of the platforms located at 34" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 19" would not allow for ADA compliant wheelchair movement nor normal passenger movement. See figure 1 below.

Figure 1 *– Non-Compliant ADA condition*
Central Avenue Station

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1.13 – MRN 233 | Essex Street / Delancey Street Station

Summary: *Essex / Delancey Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at one stair as the remaining width would be 9" (see figure 1). (Note: this report examines only the Essex Street portion of the station; See the F-line report for the Delancey Station)*

Description

Essex / Delancey Station is a below-grade station with straight side and island platforms. The platform structures are cast-in-place concrete. The width of both platforms is approximately 12'-8". Columns are spaced 15'-0" on center with faces between 1'-8" and 3'-0" from the platform edge. A stairway is located 24" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 9" would not allow for ADA compliant wheelchair movement nor normal passenger movement. (see figure 1).

Figure 1 *– Non-Compliant ADA condition*
Essex / Delancey Station

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for <u>Tier 2 Stations'</u> screening will include the following:*
>
> a. *Column location in relation to the platform edge*
> b. *Platform edge clearance adjacent to stairs and other impediments*
> c. *Impacts to ADA path of travel and boarding areas*
> d. *Conflicts of PSD/APG/RPSDs with Signals cables*
> e. *Sufficient platform width*
> f. *Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for <u>Tier 3 Stations</u> will include the following:*
>
> a. *Structural capacity of platforms to accept PSD/APG/RPSDs*
> b. *Feasibility & location for PSD/APG/RPSDs equipment room*
> c. *Confirmation of adequate power for PSD/APG/RPSDs*
> d. *Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> e. *Determination of communications requirements, availability and cost*
> f. *Determination of gap detection and entrapment avoidance technology requirements*
> g. *Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
    - Double the amount of motors as PSDs (each motor operating a single leaf).
    - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
    - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
    - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies

Assessment Factors General Factors	Specific Subfactors	PSDs	APGs	RPSDs	Grading system
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

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If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

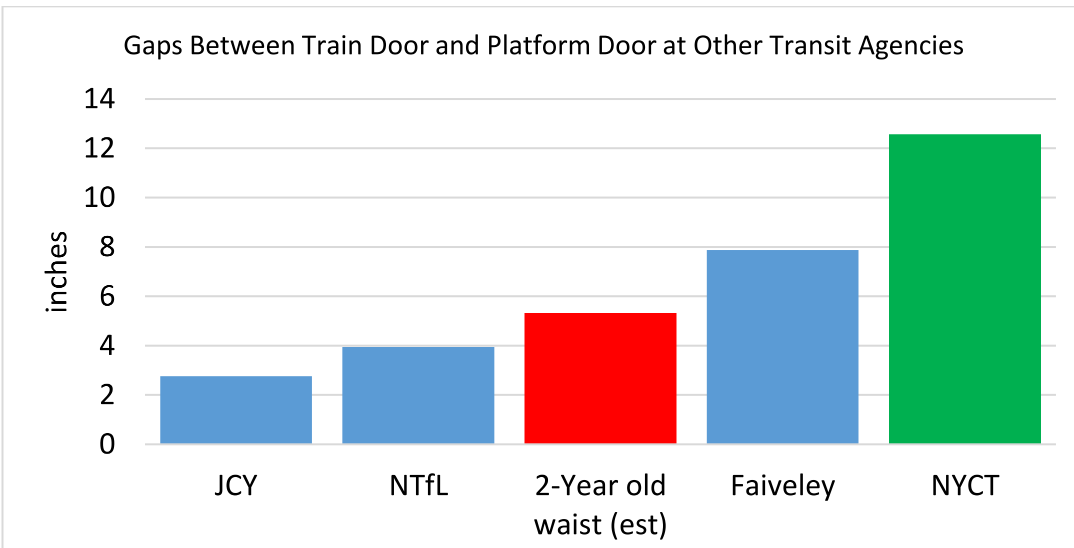


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

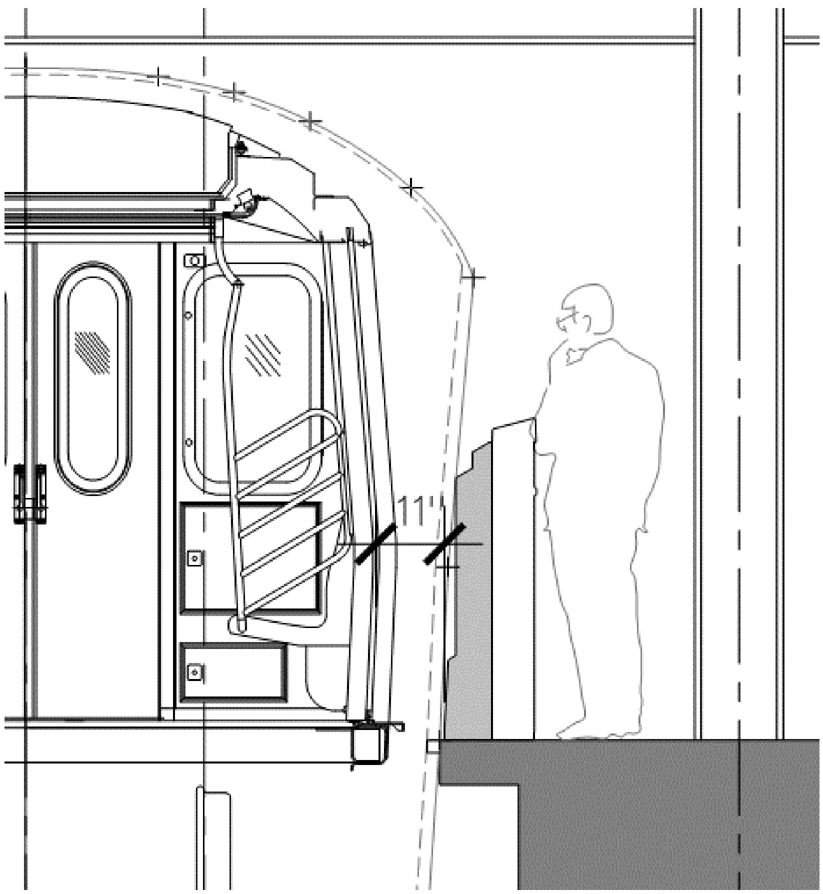


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber “bumpers” on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6” into the line equipment envelope. This would leave a 5” gap between the platform and car doors allowing approximately 2” of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5” by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor’s window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor’s window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **<u>bold/underline</u>**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	**PSD System 1**	**PSD System 2**	**PSD System 3**
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Station Capacity Analysis	**3rd Ave.**	**6th Ave.**	**14 St / Union Square**	**1st Ave.**
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are "existing" as defined by code. All the rolling stock is also to be considered "existing" under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60" radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36" of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

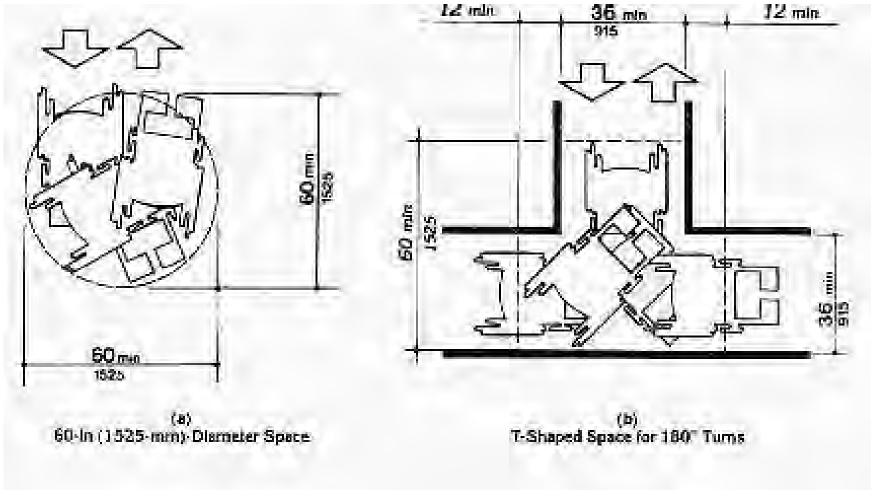
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

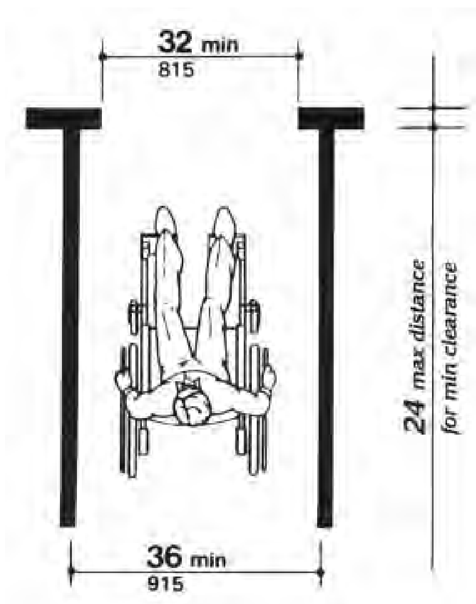


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

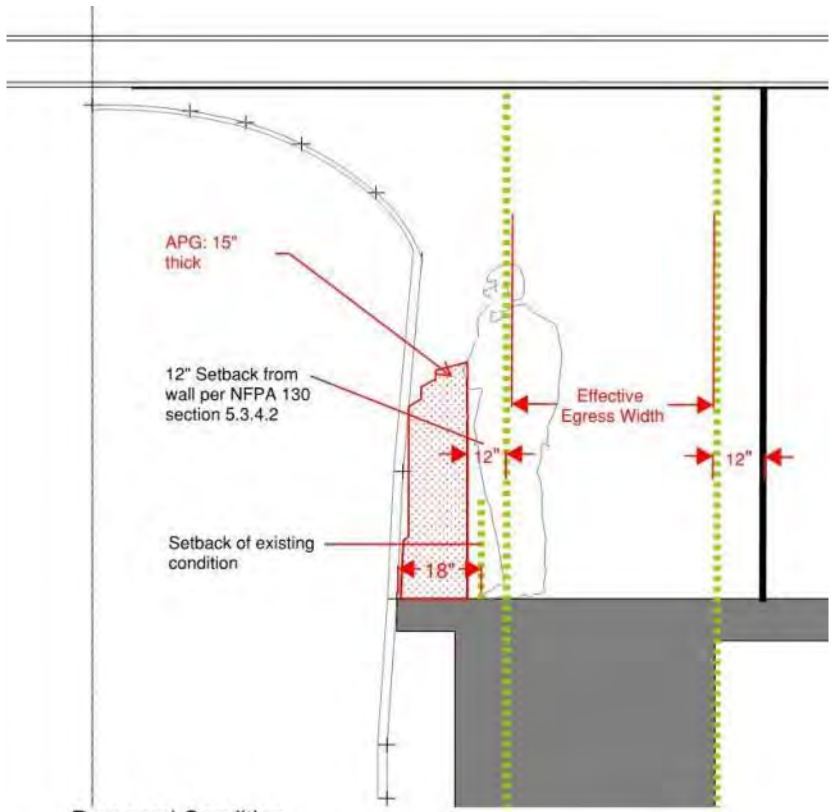
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15" of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

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Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

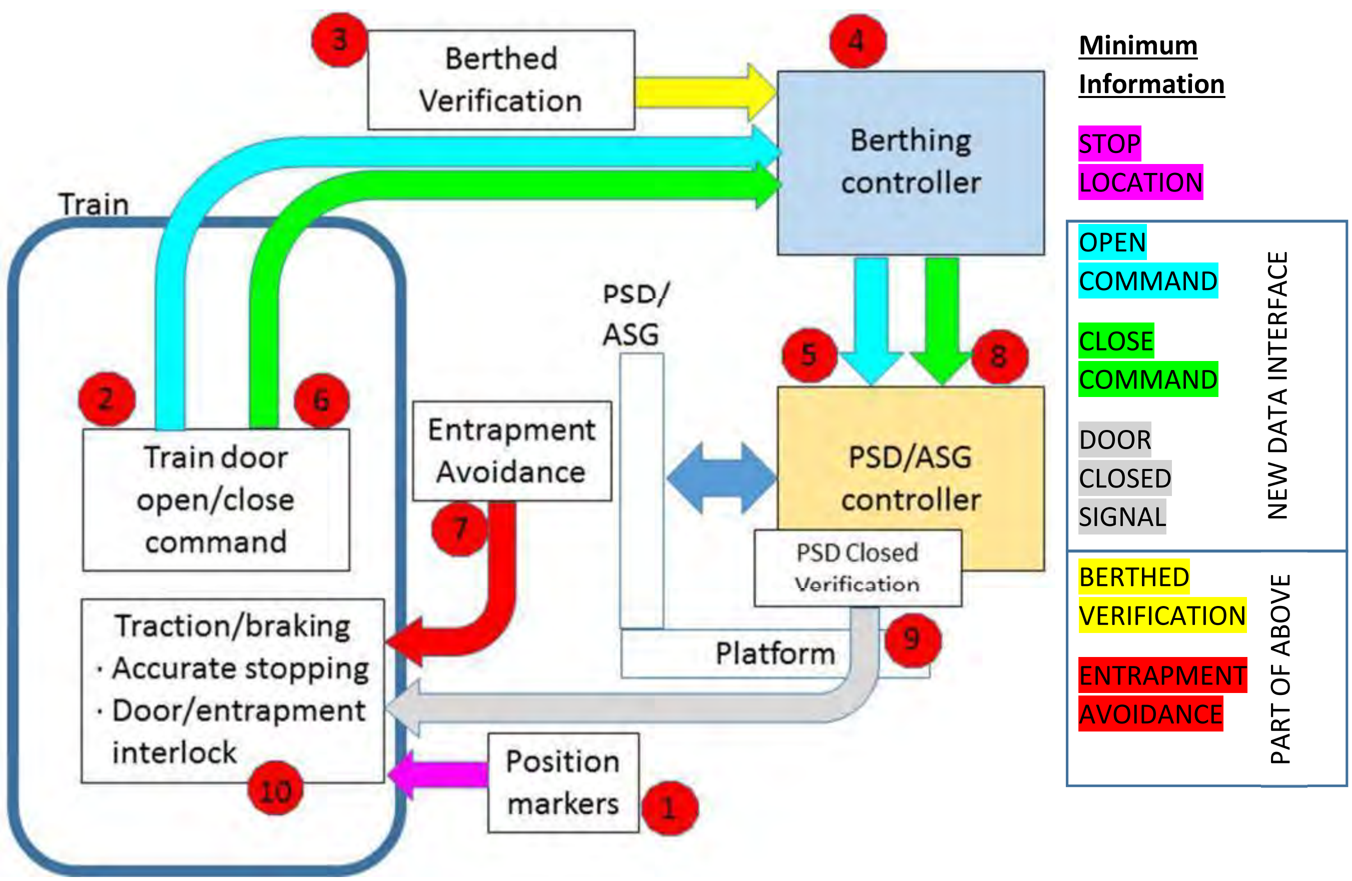
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

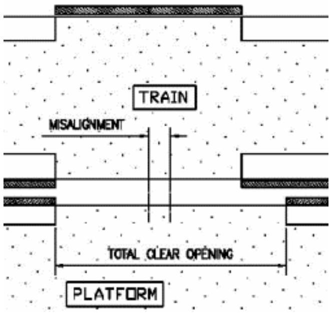
C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5” clear opening, a design for NY should meet the ADA Accessibility Guideline of 36”.

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a ‘distance totem’ which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy’s COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

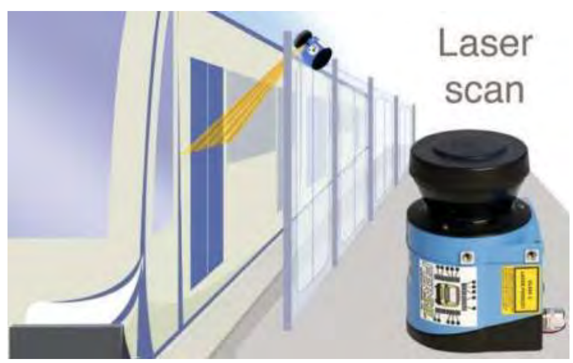
Dedicated Loop

The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically



If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.

For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

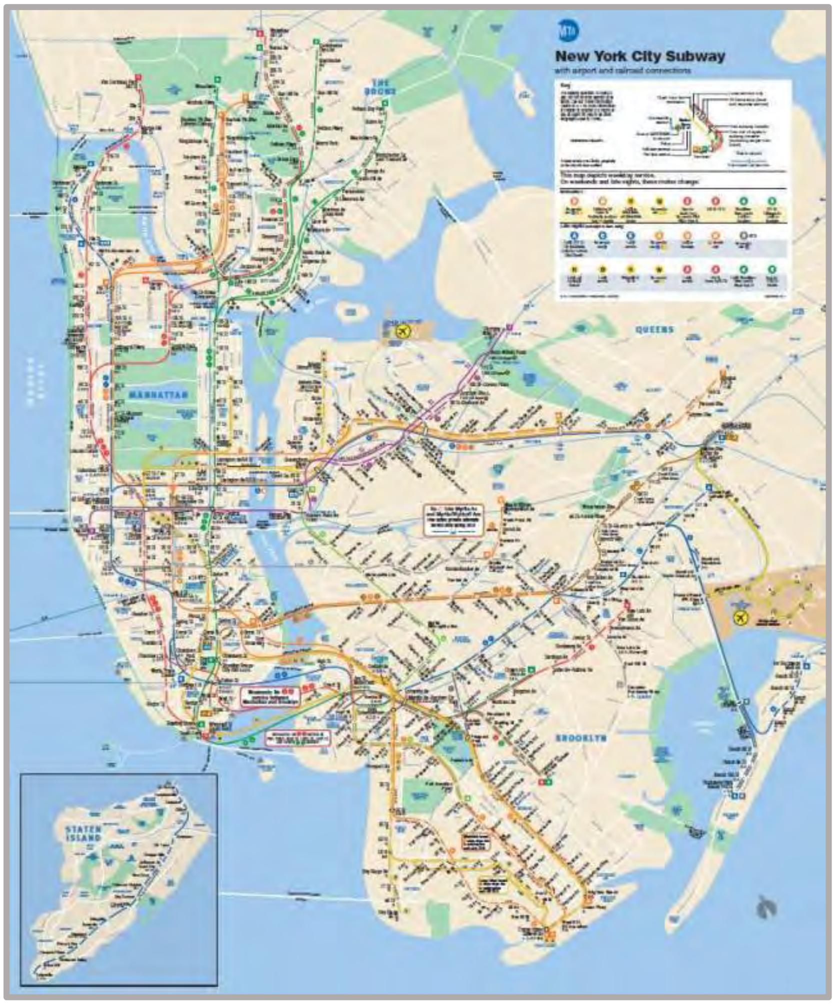


Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4’-0”). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

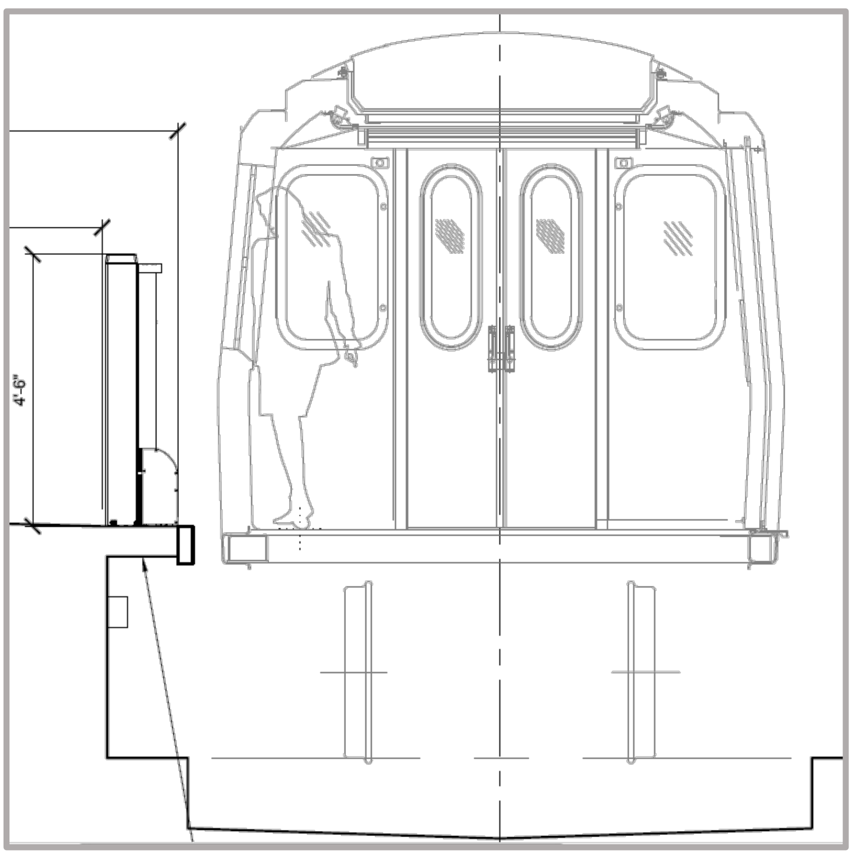


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 $lbs/ft.^2$ (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

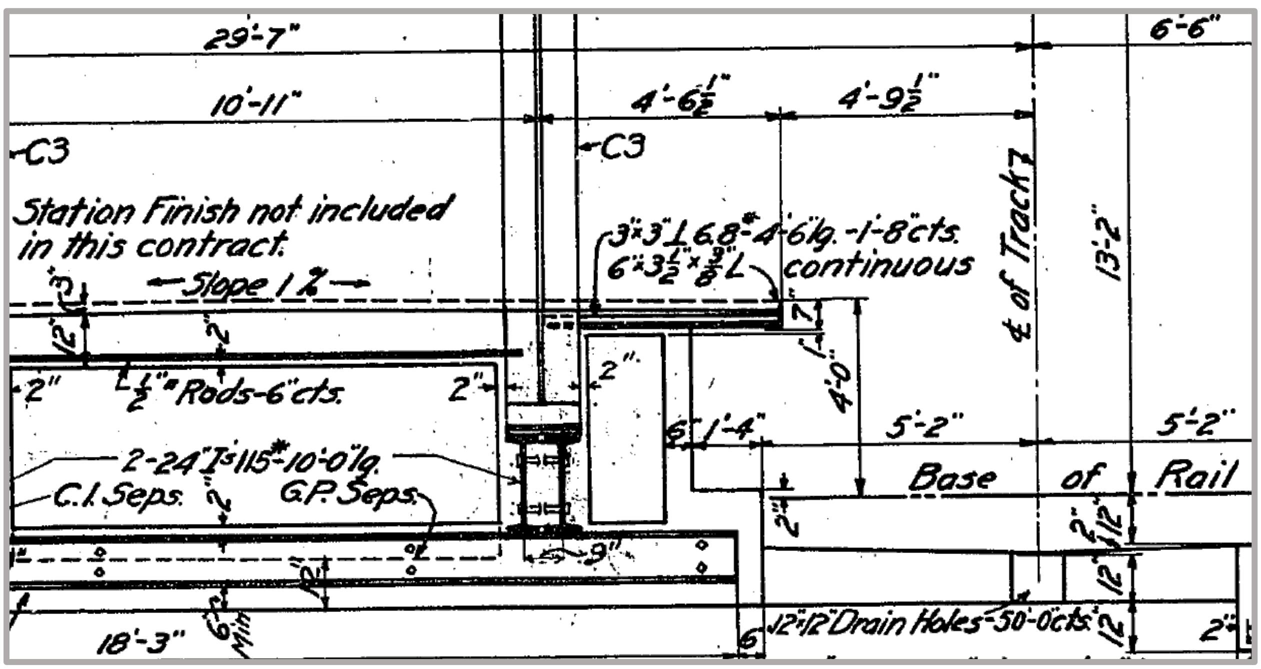


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

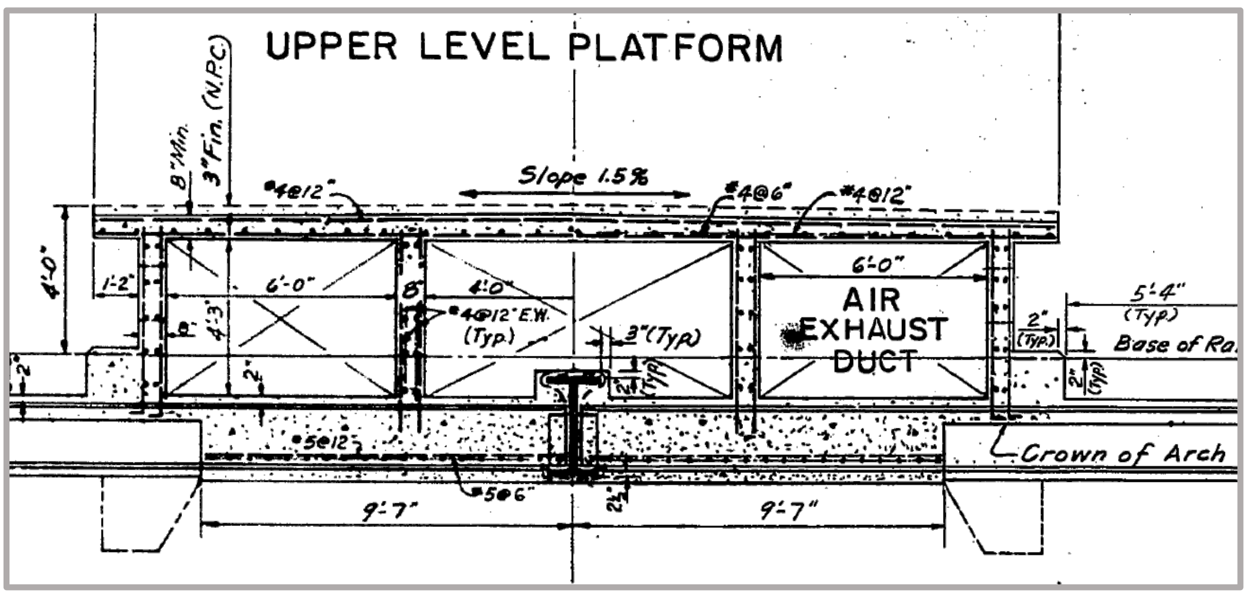


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

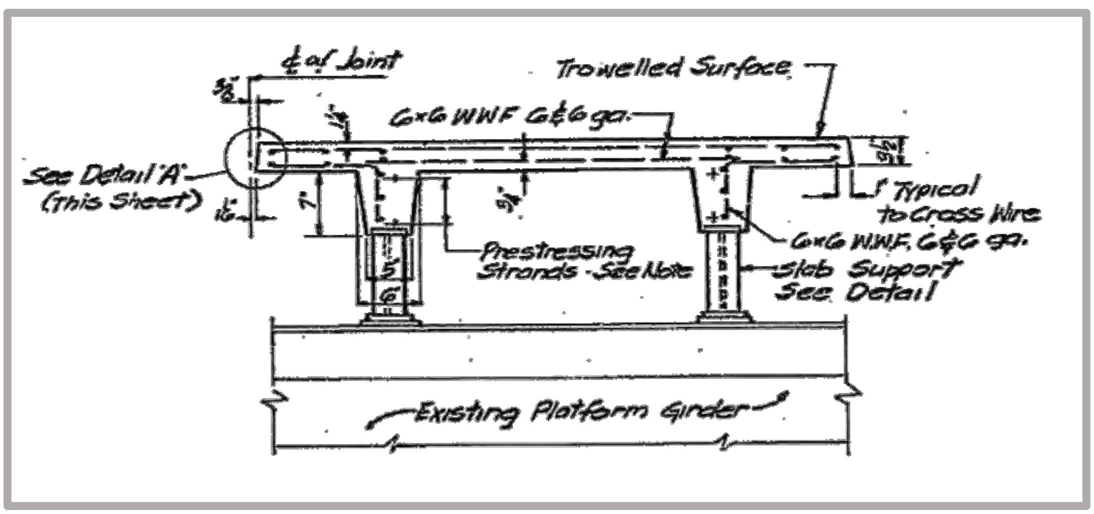


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

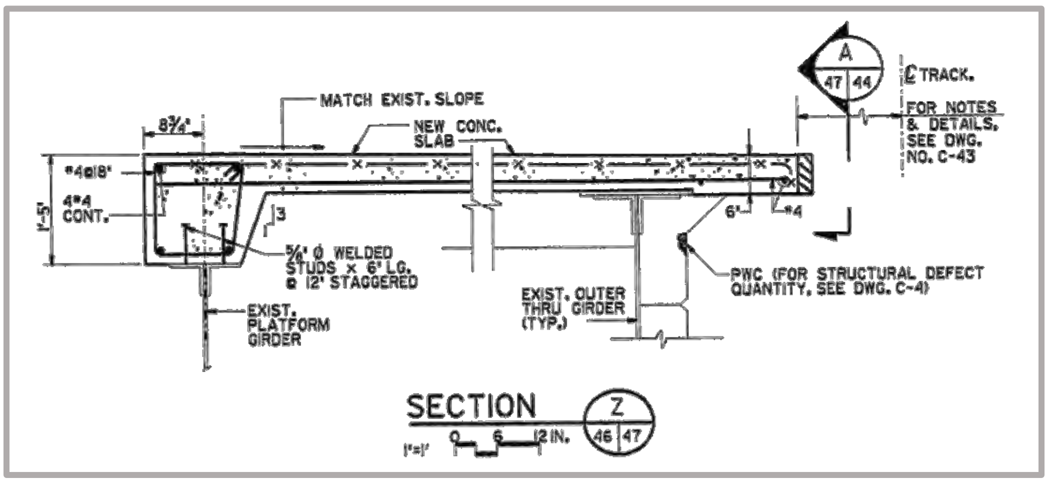


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2’-9”), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

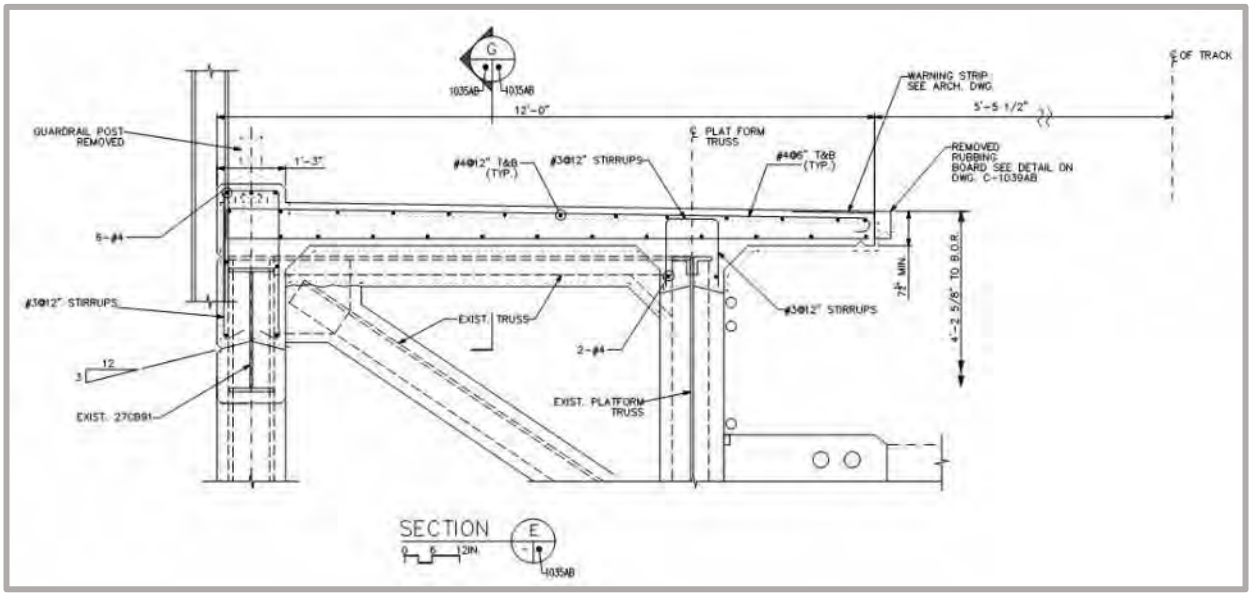


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3" thick structural slab with an approximately 3" thick topping slab. If the topping slab is fully removed, a 6" thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6" thick slab will be sufficient for a cantilever length of up to approximately 3'-0", greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6" structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6" minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

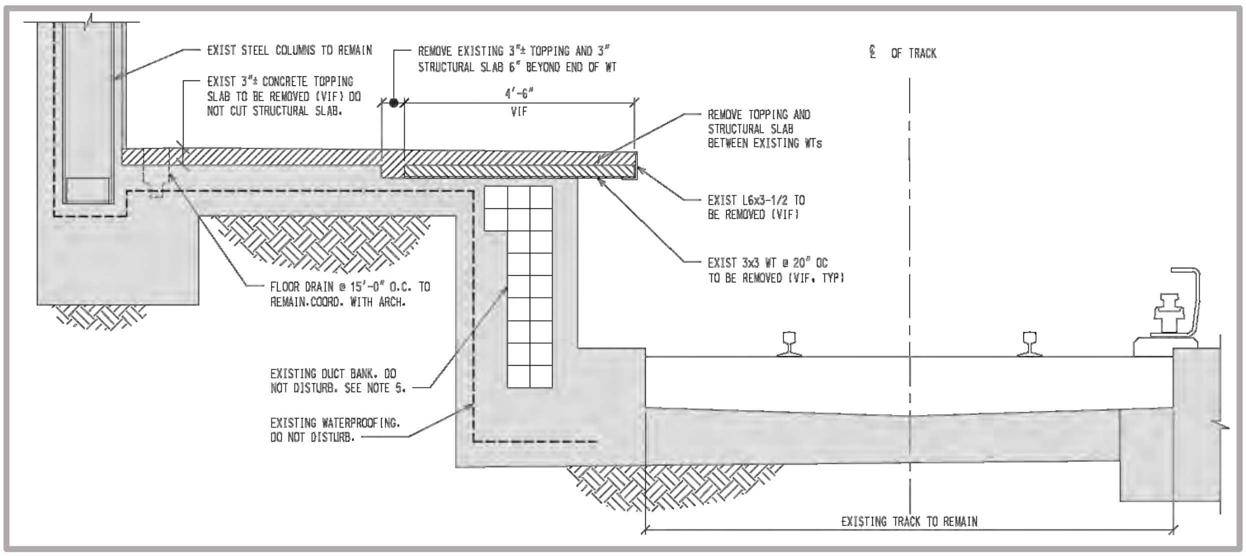


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

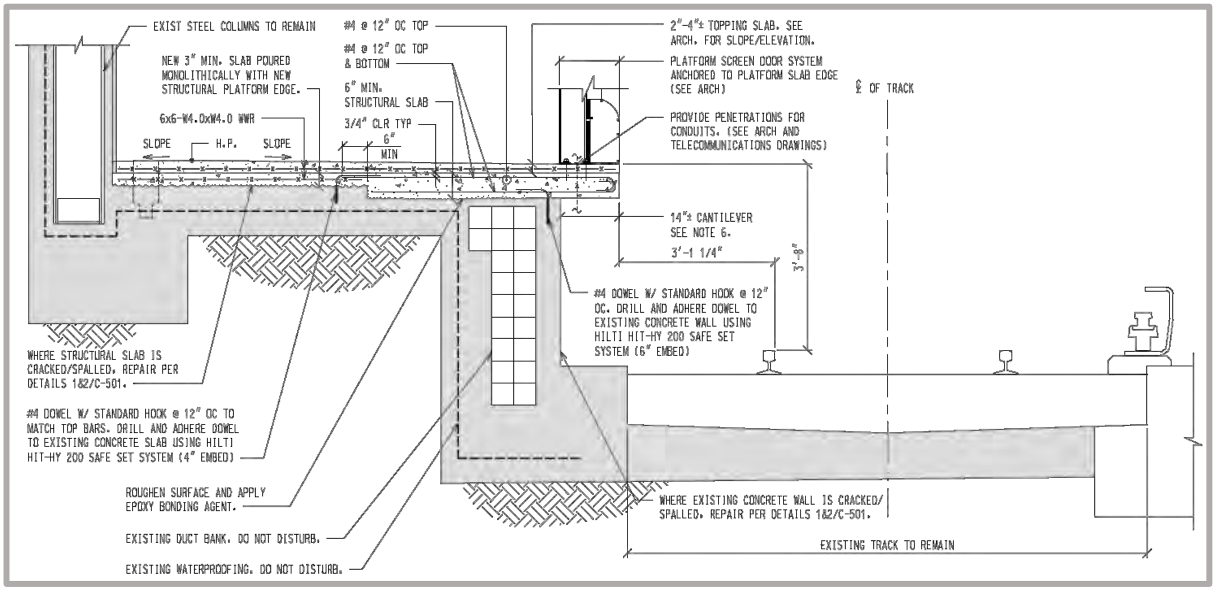


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

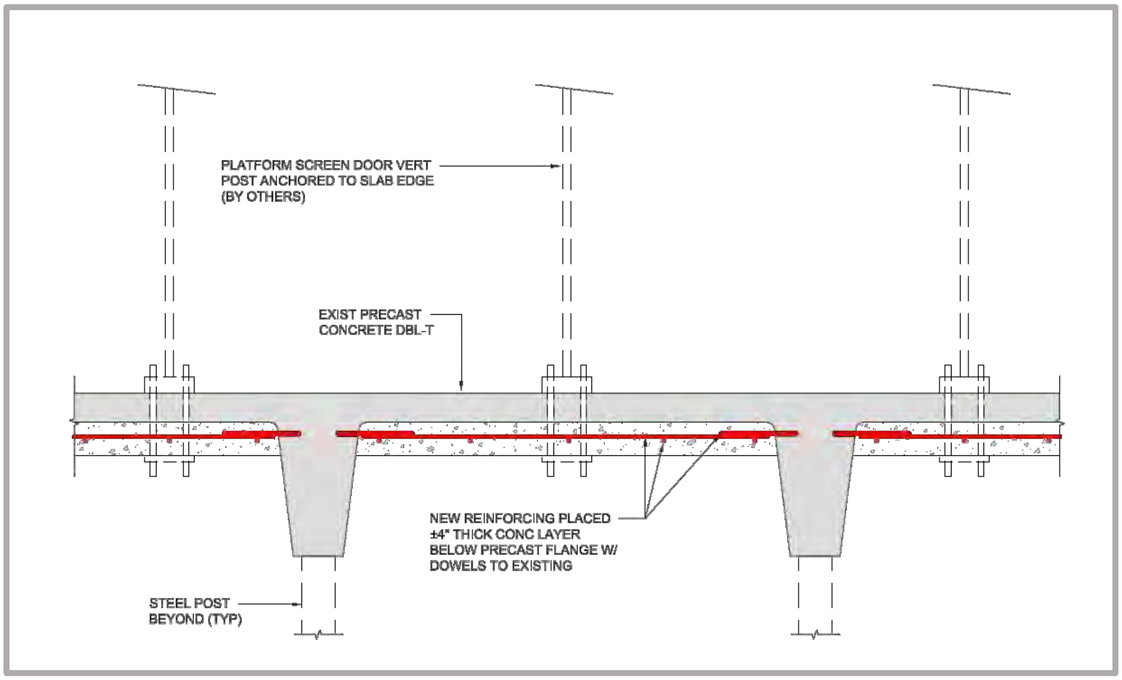


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5' – 11" of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis

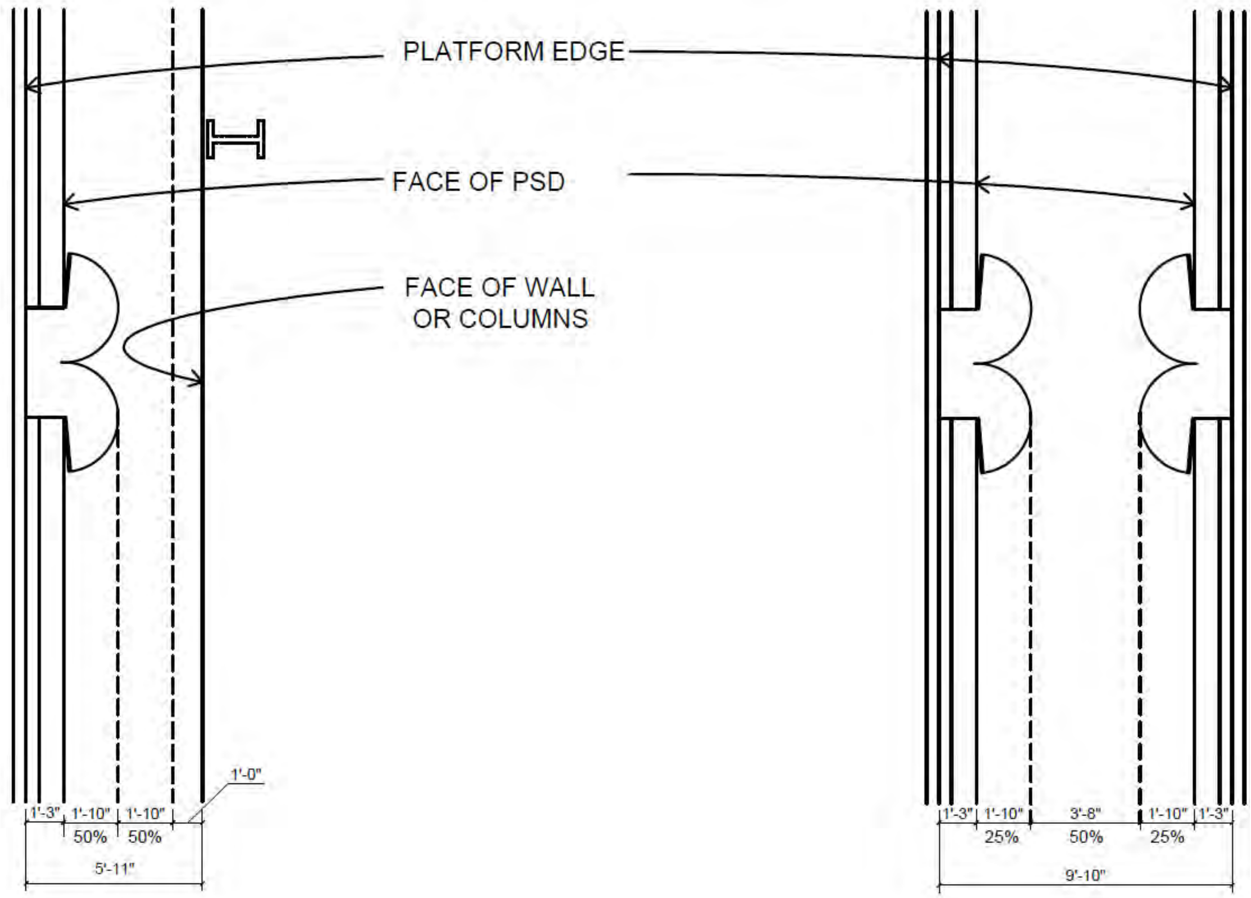


FIGURE 1: SIDE PLATFORM

FIGURE 2: CENTER PLATFORM

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

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MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the	9	$ 63,500 per month [Year 01]	$ 571,500		
	platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance	12	$ 83,590 per month [Year 02]	$ 1,003,080		
	since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
	remedial repair performed as needed, 24/7, for the	12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
	platform screen door system and ancillary equipment.					
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663

	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663

7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *	
		Year 3	$ 257 per hour *	
	Optional :	Year 4	$ 268 per hour *	
	Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

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VJ ASSOCIATES
A CONSTRUCTION CONSULTING FIRM

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations
ESTIMATE DATE:	October 29, 2018

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VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

MTA/NYCT

October 29, 2018

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.2 *APGs / PSDs will provide 31 emergency egress doors with push bars per platform*
1.3 *Each platform edge will have 40 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 It is assumed that each train has 8 cars on this line
2.2 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.3 In respect of the PSD option, only platforms that have not been upgraded in the recent past will require platform edge replacement.
2.4 There are no special security requirements made necessary by installation of the APG system
2.5 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.6 This estimate does not provide for the replacement of Platform Edge Lighting
2.7 Premium cost for night time work is considered 50% of total labor cost

3.0 ***Exclusions - Costs not included in the estimate:***

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

MTA/NYCT

October 29, 2018

BASIS OF ESTIMATE

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems
3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length
3.4 Costs associated with NYCT State Of Good Repair improvements to the station
3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.
3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs
3.7 Escalation Cost is not included; Anticipate at 5% per annum.
3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.
3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium
3.10 NYCT project cost is not included
3.11 GO and flagging cost is not included
3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or "soft" costs:***

4.1 Design and Construction Contingency
4.2 Contractor O & P
4.3 Insurance
4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 Given the limited time available, no drawings were developed to support this estimate.

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MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations
IRT Flushing Line Stations

October 29, 2018

	ORDER OF MAGNITUDE COSTS		MRN 108	MRN 109	MRN 110	MRN 112
	DESCRIPTION		MIDDLE VILLAGE METROPOLITAN AVE	FRESH POND ROAD	FOREST AVENUE 67TH AVE	MYRTLE / WYCKOFF AVE
1	AUTOMATIC PLATFORM GATES (APG'S)		$15,319,197	$14,455,717	$14,464,839	$14,850,105
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$15,319,197	$14,455,717	$14,464,839	$14,850,105
4	GENERAL REQUIREMENTS	15.00%	$2,297,880	$2,168,358	$2,169,726	$2,227,516
	SUB-TOTAL:		$17,617,077	$16,624,075	$16,634,565	$17,077,621
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,404,269	$4,156,019	$4,158,641	$4,269,405
	SUB-TOTAL:		$22,021,346	$20,780,093	$20,793,206	$21,347,026
6	OVERHEAD & PROFIT	15.00%	$3,303,202	$3,117,014	$3,118,981	$3,202,054
	SUB-TOTAL:		$25,324,547	$23,897,107	$23,912,187	$24,549,080
7	BONDS & INSURANCE	3.75%	$949,671	$896,142	$896,707	$920,591
	SUB-TOTAL:		$26,274,218	$24,793,249	$24,808,894	$25,469,671
	SUB-TOTAL:		$26,274,218	$24,793,249	$24,808,894	$25,469,671
	SUBTOTAL CONSTRUCTION COST W/O ACM		**$26,274,218**	**$24,793,249**	**$24,808,894**	**$25,469,671**
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		**$26,274,218**	**$24,793,249**	**$24,808,894**	**$25,469,671**
10	DESIGN CONSULTANT FEES	10.00%	$2,627,422	$2,479,325	$2,480,889	$2,546,967
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		$28,901,640	$27,272,574	$27,289,783	$28,016,638
	ADD ALTERNATIVES					
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		3,774,858	3,578,823	3,512,064	3,704,169
	Add for Markups (as above)	88.66%	3,346,898	3,173,088	3,113,897	3,284,223
	SUB-TOTAL PSD ALTERNATIVE		$7,121,756	$6,751,911	$6,625,961	$6,988,392
	TOTAL PROJECT COST (PSD OPTION)		$36,023,396	$34,024,485	$33,915,744	$35,005,030

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : MIDDLE VILLAGE METROPOLITAN AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	538	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	538	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,076**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**8**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,076	LF	7	7,535
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,382	SF	12	64,584
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	108	CY	2,500	270,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,078	EA	25	26,960
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,078	EA	25	26,960
19	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
20	Polyethylene edge strip	1,076	LF	95	102,258
21	Provide sleeves for HV & LV wires	264	EA	110	29,040
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,076	LF	15	16,146
26	Remove existing platform tiles	1,076	LF	12	12,917
27	Sawcut existing topping concrete at perimeter of removal area	1,076	LF	5	5,382
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,458	SF	8	51,667
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,076	SF	15	16,146

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : MIDDLE VILLAGE METROPOLITAN AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	384	LF	110	42,240
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-6" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	70	LF	90	6,300
39	CMU Wall for equipment room	700	SF	45	31,500
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	206	SF	30	6,188
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	700	SF	40	28,000
45	Mosaic Band to match existing - Assuming 8" high	70	LF	120	8,400
46	Concrete cove to match existing	70	LF	20	1,400
47	Interior Wall Finish - Paint	700	SF	5	3,500
48	Allow for Misc. floor & ceiling finishes	206	SF	15	3,094
49	Allow for 4" thick concrete pads for equipment	52	SF	20	1,031
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	10,500	651,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,207	SF	750	1,655,100
61	Spare Parts - Approx. 10% of Material Cost	1	LS	201,486	201,486
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,500,000	1,500,000
64	Allowance for Braille Signage	64	EA	2,500	160,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : MIDDLE VILLAGE METROPOLITAN AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,076	LF	60	64,584
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	500	LF	60	30,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	550	LF	60	33,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	Remove, store and reinstall existing signal light	1	EA	5,000	5,000
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
97	Engineering and Testing	1,000	Hrs	160	159,930
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : MIDDLE VILLAGE METROPOLITAN AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	**Training**				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	**Out of hours Work**				
112	Allow loss of production to work at night say 50%	1	LS	3,535,199	3,535,199
113					
114	TOTAL PSD WORK:				$ 15,319,197

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (8 Cars x 4 Doors =32 No. per platform)	64	EA	25,000	1,600,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	15,000	930,000
124	Double egress/service gate in the center of the platform; #1 per Platform	4	EA	30,000	120,000
125	Platform End Gates (PEGs)	8	EA	18,000	144,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	4,705	SF	750	3,528,693
127	Spare Parts - Approx. 10% of Material Cost	1	LS	379,362	379,362
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	4	TONS	17,500	71,623
130	L6x6x1/2 continuous angle	8	TONS	17,500	138,640
131	Drilling and bolting - 4 bolts at each connection	431	EA	216	93,001
132	Platform Edge Repair				
133	Remove concrete platform edge				Previously done
134	Platform edge repair				Previously done
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
136					
137	OMIT				
138	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	(64)	EA	15,000	(960,000)
139	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	(62)	EA	10,500	(651,000)
140	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
141	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
142	Fixed Panels including framing and support; 4'-6" High	(2,207)	SF	750	(1,655,100)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : MIDDLE VILLAGE METROPOLITAN AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
143	Spare Parts - Approx. 10% of Material Cost	(1)	LS	201,486	(201,486)
144	Platform Edge Reconstruction work	(1)	LS	480,664	(480,664)
145	Remove allowance for cast in sleeves for LV & HV power	(264)	EA	110	(29,040)
146	Conduit running under Platform Edge	(1,076)	LF	30	(32,292)
147					
148	Allow loss of production to work at night say 50%	1	LS	871,121	871,121
149					
150	**PREMIUM ASSOCIATED WITH PSD's**				**$ 3,774,858**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : FRESH POND ROAD

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	525	LF		
5	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	525	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,050**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**8**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,050	LF	7	7,351
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,251	SF	12	63,006
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	106	CY	2,500	265,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,052	EA	25	26,303
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,052	EA	25	26,303
19	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
20	Polyethylene edge strip	1,050	LF	95	99,760
21	Provide sleeves for HV & LV wires	264	EA	110	29,040
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,050	LF	15	15,752
26	Remove existing platform tiles	1,050	LF	12	12,601
27	Sawcut existing topping concrete at perimeter of removal area	1,050	LF	5	5,251
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,301	SF	8	50,405
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,050	SF	15	15,752

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : FRESH POND ROAD

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	384	LF	110	42,240
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-6" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	63	LF	90	5,625
39	CMU Wall for equipment room	625	SF	45	28,125
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	206	SF	30	6,188
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	625	SF	40	25,000
45	Mosaic Band to match existing - Assuming 8" high	63	LF	120	7,500
46	Concrete cove to match existing	63	LF	20	1,250
47	Interior Wall Finish - Paint	625	SF	5	3,125
48	Allow for Misc. floor & ceiling finishes	206	SF	15	3,094
49	Allow for 4" thick concrete pads for equipment	52	SF	20	1,031
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	10,500	651,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,088	SF	750	1,566,338
61	Spare Parts - Approx. 10% of Material Cost	1	LS	196,160	196,160
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	64	EA	2,500	160,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : FRESH POND ROAD

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,050	LF	60	63,006
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	200	LF	60	12,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : FRESH POND ROAD

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,335,935	3,335,935
113	TOTAL PSD WORK:				$ 14,455,717

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	64	EA	25,000	1,600,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	62	EA	15,000	930,000
123	Double egress/service gate in the center of the platform; #1 per Platform	4	EA	30,000	120,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,495	SF	750	3,370,893
126	Spare Parts - Approx. 10% of Material Cost	1	LS	365,574	365,574
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	69,905
129	L6x6x1/2 continuous angle	8	TONS	17,500	135,253
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135					
136	OMIT				
137	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	(64)	EA	15,000	(960,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(62)	EA	10,500	(651,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
141	Fixed Panels including framing and support; 4'-6" High	(2,088)	SF	750	(1,566,338)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : FRESH POND ROAD

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Spare Parts - Approx. 10% of Material Cost	(1)	LS	196,160	(196,160)
143	Platform Edge Reconstruction work	(1)	LS	472,771	(472,771)
144	Remove allowance for cast in sleeves for LV & HV power	(264)	EA	110	(29,040)
145	Conduit running under Platform Edge	(1,050)	LF	30	(31,503)
146					
147	Allow loss of production to work at night say 50%	1	LS	825,882	825,882
148					
149	**PREMIUM ASSOCIATED WITH PSD's**				**3,578,823**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : FOREST AVENUE 67TH AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	527	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	527	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,053**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**8**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,053	LF	7	7,374
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,267	SF	12	63,204
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	106	CY	2,500	265,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,055	EA	25	26,385
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,055	EA	25	26,385
19	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
20	Polyethylene edge strip	1,053	LF	95	100,073
21	Provide sleeves for HV & LV wires	264	EA	110	29,040
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,053	LF	15	15,801
26	Remove existing platform tiles	1,053	LF	12	12,641
27	Sawcut existing topping concrete at perimeter of removal area	1,053	LF	5	5,267
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,320	SF	8	50,563
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,053	SF	15	15,801

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : FOREST AVENUE 67TH AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	384	LF	110	42,240
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-6" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	63	LF	90	5,625
39	CMU Wall for equipment room	625	SF	45	28,125
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	206	SF	30	6,188
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	625	SF	40	25,000
45	Mosaic Band to match existing - Assuming 8" high	63	LF	120	7,500
46	Concrete cove to match existing	63	LF	20	1,250
47	Interior Wall Finish - Paint	625	SF	5	3,125
48	Allow for Misc. floor & ceiling finishes	206	SF	15	3,094
49	Allow for 4" thick concrete pads for equipment	52	SF	20	1,031
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	10,500	651,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,103	SF	750	1,577,475
61	Spare Parts - Approx. 10% of Material Cost	1	LS	196,829	196,829
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	64	EA	2,500	160,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : FOREST AVENUE 67TH AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,053	LF	60	63,204
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : FOREST AVENUE 67TH AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,338,040	3,338,040
112					
113	TOTAL PSD WORK:				$ 14,464,839

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	15,000	930,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,521	SF	750	3,390,693
126	Spare Parts - Approx. 10% of Material Cost	1	LS	363,162	363,162
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	70,121
129	L6x6x1/2 continuous angle	8	TONS	17,500	135,678
130	Drilling and bolting - 4 bolts at each connection	421	EA	216	91,014
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135					
136	OMIT				
137	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	(64)	EA	15,000	(960,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(62)	EA	10,500	(651,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
141	Fixed Panels including framing and support; 4'-6" High	(2,103)	SF	750	(1,577,475)
142	Spare Parts - Approx. 10% of Material Cost	(1)	LS	196,829	(196,829)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : FOREST AVENUE 67TH AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
143	Platform Edge Reconstruction work	(1)	LS	473,134	(473,134)
144	Remove allowance for cast in sleeves for LV & HV power	(264)	EA	110	(29,040)
145	Conduit running under Platform Edge	(1,053)	LF	30	(31,602)
147	Allow loss of production to work at night say 50%	1	LS	810,476	810,476
148					
149					
150	**PREMIUM ASSOCIATED WITH PSD's**				**$ 3,512,064**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : MYRTLE / WYCKOFF AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	556	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	556	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,112**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**8**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,112	LF	7	7,783
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,559	SF	12	66,708
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	112	CY	2,500	280,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,114	EA	25	27,845
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,114	EA	25	27,845
19	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
20	Polyethylene edge strip	1,112	LF	95	105,621
21	Provide sleeves for HV & LV wires	264	EA	110	29,040
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,112	LF	15	16,677
26	Remove existing platform tiles	1,112	LF	12	13,342
27	Sawcut existing topping concrete at perimeter of removal area	1,112	LF	5	5,559
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,671	SF	8	53,366
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,112	SF	15	16,677

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : MYRTLE / WYCKOFF AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	384	LF	110	42,240
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-6" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	63	LF	90	5,625
39	CMU Wall for equipment room	625	SF	45	28,125
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	206	SF	30	6,188
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	625	SF	40	25,000
45	Mosaic Band to match existing - Assuming 8" high	63	LF	120	7,500
46	Concrete cove to match existing	63	LF	20	1,250
47	Interior Wall Finish - Paint	625	SF	5	3,125
48	Allow for Misc. floor & ceiling finishes	206	SF	15	3,094
49	Allow for 4" thick concrete pads for equipment	52	SF	20	1,031
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	10,500	651,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,366	SF	750	1,774,575
61	Spare Parts - Approx. 10% of Material Cost	1	LS	208,655	208,655
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	64	EA	2,500	160,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : MYRTLE / WYCKOFF AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,112	LF	60	66,708
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	400	LF	60	24,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	450	LF	60	27,000
76	Allowance for power to cross tracks to opposite platform	1	LS	15,000	15,000
77	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	**Communications**				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
97	Engineering and Testing	1,000	Hrs	160	159,930
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : MYRTLE / WYCKOFF AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	3,426,947	3,426,947
114	TOTAL PSD WORK:				$ 14,850,105

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	15,000	930,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	4,988	SF	750	3,741,093
127	Spare Parts - Approx. 10% of Material Cost	1	LS	384,186	384,186
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	4	TONS	17,500	73,936
130	L6x6x1/2 continuous angle	8	TONS	17,500	143,200
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Platform Edge Repair				
133	Remove concrete platform edge				Previously done
134	Platform edge repair				Previously done
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
136					
137	OMIT				
138	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	(64)	EA	15,000	(960,000)
139	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	(62)	EA	10,500	(651,000)
140	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
141	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for M - Line Stations

29-Oct-18

STATION : MYRTLE / WYCKOFF AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Fixed Panels including framing and support; 4'-6" High	(2,366)	SF	750	(1,774,575)
143	Spare Parts - Approx. 10% of Material Cost	(1)	LS	208,655	(208,655)
144	Platform Edge Reconstruction work	(1)	LS	494,558	(494,558)
145	Remove allowance for cast in sleeves for LV & HV power	(264)	EA	110	(29,040)
146	Conduit running under Platform Edge	(1,112)	LF	30	(33,354)
147					
148	Allow loss of production to work at night say 50%	1	LS	854,808	854,808
149					
150	**PREMIUM ASSOCIATED WITH PSD's**				**$ 3,704,169**

MTA New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR ‘G’ LINE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

SUBMITTAL DATE: December, 26 2018

STV 100 Years

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Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 21 newly evaluated stations, 15 have been found to be not suitable for the installation of PSDs.

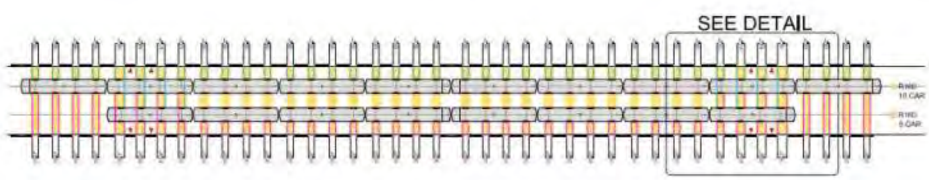
[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to low-height barriers]

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues; the platform edge barriers are 15" wide. Where an existing object (wall, stair, railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Where these PSDs hamper the ability of a wheelchair to turn (a 5'-0" circle) and/or limit path of travel to less than 32" pinch width, it is declared infeasible. This requirement dictates that if a column or any obstruction measuring less than or equal to 24" in the direction of circulation is present, it may not constrain the circulation path to less than 32".
- Insufficient space for the PSD equipment room; the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow; due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements in regard to the placement of these new barriers in an existing station environment.
- Structural considerations; existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.

- Car door misalignment (part of Tier 1 selection process): Presently (2018) the NYCT system features three car geometries on the A Division and three car geometries on the B Division. With few exceptions, these cars are freely mixed between lines. The spacing of doors on these differing cars is significantly misaligned, making the installation of platform doors infeasible. Looking to the future, NYCT plans to procure new rolling stock with identical or nearly identical door spacing. The current procurement schedule indicates the purchase of these geometrically compatible cars by 2032. Therefore, our assessment of feasibility is based on the year 2032.

  However, the G line service and an overlapping service on the B Division will remain incompatible even after 2032. Per discussions with Operations Planning, (see Appendix F) future trains will consist of eight 60-foot cars, whereas the F line is a ten-car train. The newer trains are assembled in two consists, with a driver / conductor cabin at the front and back of each consist. Due to the cabin, the spacing of doors on the first and last car differs from the door spacing of the other cars of the train. Therefore, there will inevitably be a mismatching of doors as these two differing train types berth at a certain station platform. The G train ridership does not warrant a ten-car train, so this incompatibility will likely remain into the foreseeable future. Therefore, 8 of the 21 stations are infeasible due to this incompatibility. Please see the diagrams in Figure 1 below.



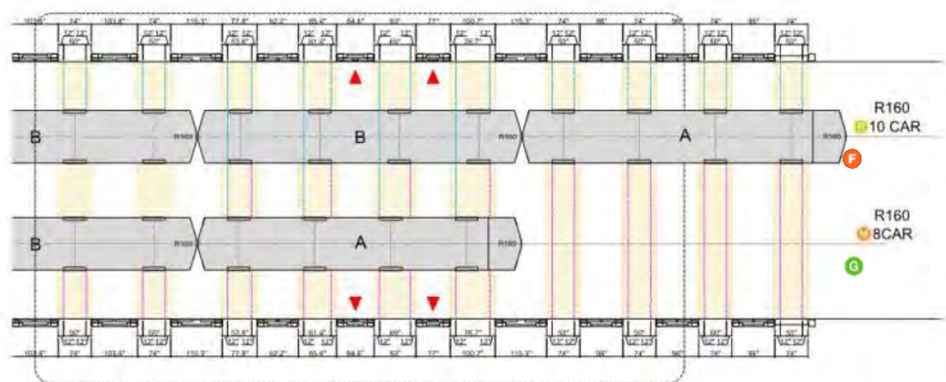


***Figure 1** – Ten-car vs. eight-car train*
Comparison of door geometry

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the previously proposed 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the PSD barriers and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is used for refuse removal at 13 of the stations on the 'G' Line. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the (off) loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in damage from these carts along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 29% of the 'G' Line stations. Total implementation cost would be $183.4M for APGs and $239.6M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; That estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of $931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 6 feasible stations, the aggregate annual maintenance cost would be $5.6M.

Summary Table

G Line Summary of Feasibility					(29% feasible; 6/21)		
MR No.	**Station Name**	**Station Type**	**Platform Type**	**Feasible Yes / No**	**Issues / Reason for Failure**	**Cost APGs**	**Cost PSDs**
175	Hoyt & Schermerhorn Sts.	Below-grade	Center/ Island	No	ADA Clearance	-	-
236	Bergen Street	Below-grade	Side	No	Tier 1 Failure- train door misalignment		
237	Carroll Street	Below-grade	Side	No	Tier 1 Failure- train door misalignment		
238	Smith-9th Streets	Elevated	Side	No	Tier 1 Failure- train door misalignment		
239	4th Avenue	Elevated	Side	No	Tier 1 Failure- train door misalignment & ADA clearance		
240	7th Avenue	Below-grade	Center/ Island	No	Tier 1 Failure- train door misalignment		
241	15th Street-Prospect Park	Below-grade	Center/ Island	No	Tier 1 Failure- train door misalignment & ADA clearance		
242	Fort Hamilton Parkway	Below-grade	Side	No	Tier 1 Failure- train door misalignment & Equipment room		
243	Church Avenue	Below-grade	Center/ Island	No	Tier 1 Failure- train door misalignment & ADA clearance		
281	Court Sq.	Below-grade	Center/ Island	No	ADA Clearance	-	-
282	21st St. Jackson Ave.	Below-grade	Center/ Island	No	ADA Clearance	-	-
283	Greenpoint Ave	Below-grade	Side	Yes	-	$30.4M	$39.9M
284	Nassau Ave	Below-grade	Side	Yes	-	$30.8M	$41.1M
285	Metropolitan Ave	Below-grade	Side	No	ADA Clearance	-	-
286	Broadway	Below-grade	Side	No	ADA Clearance	-	-
287	Flushing Ave	Below-grade	Side	Yes	-	$30.6M	$39.3M
288	Myrtle Willoughby Avs	Below-grade	Side	No	ADA Clearance	-	-
289	Bedford Nostrand Aves	Below-grade	Center/ Island	No	ADA Clearance	-	-
290	Classon Ave	Below-grade	Side	Yes	-	$30.5M	$39.4M
291	Clinton- Washington Avs	Below-grade	Side	Yes	-	$30.4M	$39.3M
292	Fulton Street	Below-grade	Side	Yes	-	$30.8M	$40.6M
					TOTAL	**183.4M**	**239.6M**

1.0 Station Assessments

1.01 – MRN 175 | Hoyt Schermerhorn Streets

Summary: *Hoyt Schermerhorn Streets Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 25" (see Figure 1). This condition occurs at multiple stairs both station platforms.*

Description

Hoyt Schermerhorn Streets Station is a below-grade station with four platforms, two open revenue platforms in the center and two abandoned platforms on the sides. The revenue platforms are in island configuration, they are straight and have slight curves at their southern ends. The platform structures are cast-in-place concrete. The width of the platforms is approximately 20'-6" throughout tapering down to 16'-10" at the southern end of the station. There are three staircases along each revenue platform, all of which would not allow for the 32" pinch-point width required for wheelchair movement with PSDs installed. These staircases are centered on the platform and flanked on both sides by the typical station columns, where the column face is 3'-4" away from adjacent platform edge. Passengers requiring an ADA-compliant path of travel can currently move along the platform in the 3'-4" between columns and the platform edge. As seen in Figure 1, the implementation of a platform edge barrier would reduce this width below the required minimum of 32" for pinch-points, the remaining 25" would not allow for ADA compliant wheelchair movement.

Figure 1: *Non-Compliant ADA condition at stairs (typical on all platforms)*
MRN 175: Hoyt Schermerhorn Streets Station

1.02 – MRN 281 | Court Square Station

Summary: *Court Square Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA complaint wheelchair movement would not be met at all 4 staircases on the platform (See Figure 1). Wheelchair paths at the aforementioned locations would be constricted to less than 32".*

Description

Court Square Station is a below-grade station with one straight center/island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 19'-6" throughout. There are four staircases along the platform and two rooms, all of which would not allow for the 32" pinch-point width required for wheelchair movement with PSDs installed. Columns are spaced 15' on center with column faces 3'-5" away from all platform edges. The stairs are not centered on the platform but shifted towards the southbound track edge. All stairs are flanked on both side by the aforementioned typical station columns. Passengers requiring an ADA-compliant path of travel can currently move along the platform in the 3'-5" between columns and the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 32" for pinch-points. The remaining 26" would not allow for ADA compliant wheelchair movement. Please see Figure 1 for reference

***Figure 1** – Non-Compliant ADA condition*
MRN 281: Court Square

1.03 – MRN 282 | 21st Street Van Alst Jackson Avenue

Summary: *21st Street Van Alst Jackson Avenue is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA complaint wheelchair movement would not be met at both staircases on the platform. Wheelchair paths at the staircase locations would be constricted to less than 32".*

Description

21st Street Van Alst Jackson Avenue is a below-grade station with one straight center/island platforms. The platform structure is cast-in-place concrete. The width of the platform is approximately 19'-4" throughout. There are two open staircases along the platform (and one closed staircase at the south end), both of which would not allow for the 32" pinch-point width required for wheelchair movement with PSDs installed. Columns are spaced 15' on center with column faces 3'-5" away from all platform edges. The stairs are centered on the platform. The stair are flanked on both sides by the typical station columns. Passengers requiring an ADA-compliant path of travel can currently move along the platform in the 3'-5" between columns and the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 32" for pinch-points. The remaining 26" would not allow for ADA compliant wheelchair movement. Please see Figure 1 for reference

Figure 1 *– Non-Compliant ADA condition at staircase P5*
MRN 282: 21st Street Van Alst Jackson A

1.04 – MRN 283 | Greenpoint Avenue Station

Summary: *Greenpoint Avenue Station is feasible for both APGs and PSDs. There is a continuous standpipe running through multiple locations of the platform edges (see Figure 3). This standpipe would likely need to be relocated in the implementation of a full height PSD system. There are also two ceiling mounted monitors located above the southbound platform edge with a vertical clearance of 6'8", which would also require relocation. Platform edge reconstruction will be required to support the requirements of an APG (see structural report; Appendix B). Electrical capacity at this station is adequate to support a APG/PSD system*

Description

Greenpoint Avenue Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 3'-2" from the platform edge. The southbound platform width is approximately 11'-6" throughout. The northbound platform width is approximately 11'-8" throughout. On the southbound platform there are two ceiling mounted monitors located above the platform edge, with a vertical clearance of 6'-8", (see Figure 3). Ceiling heights measure no less than 7'-6" throughout. Please see Figure 1 for overall station plan and Figure 2 for an enlarged room location.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. The varying ceiling heights throughout the station. Ceiling mounted monitors located above the platform edge would need to be relocated in the implementation of full height PSDs (see figure 3).

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located in the southeast of the mezzanine, flush to the wall as seen in Figure 2. The proposed room dimension is 27'-0" x 11'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 1. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

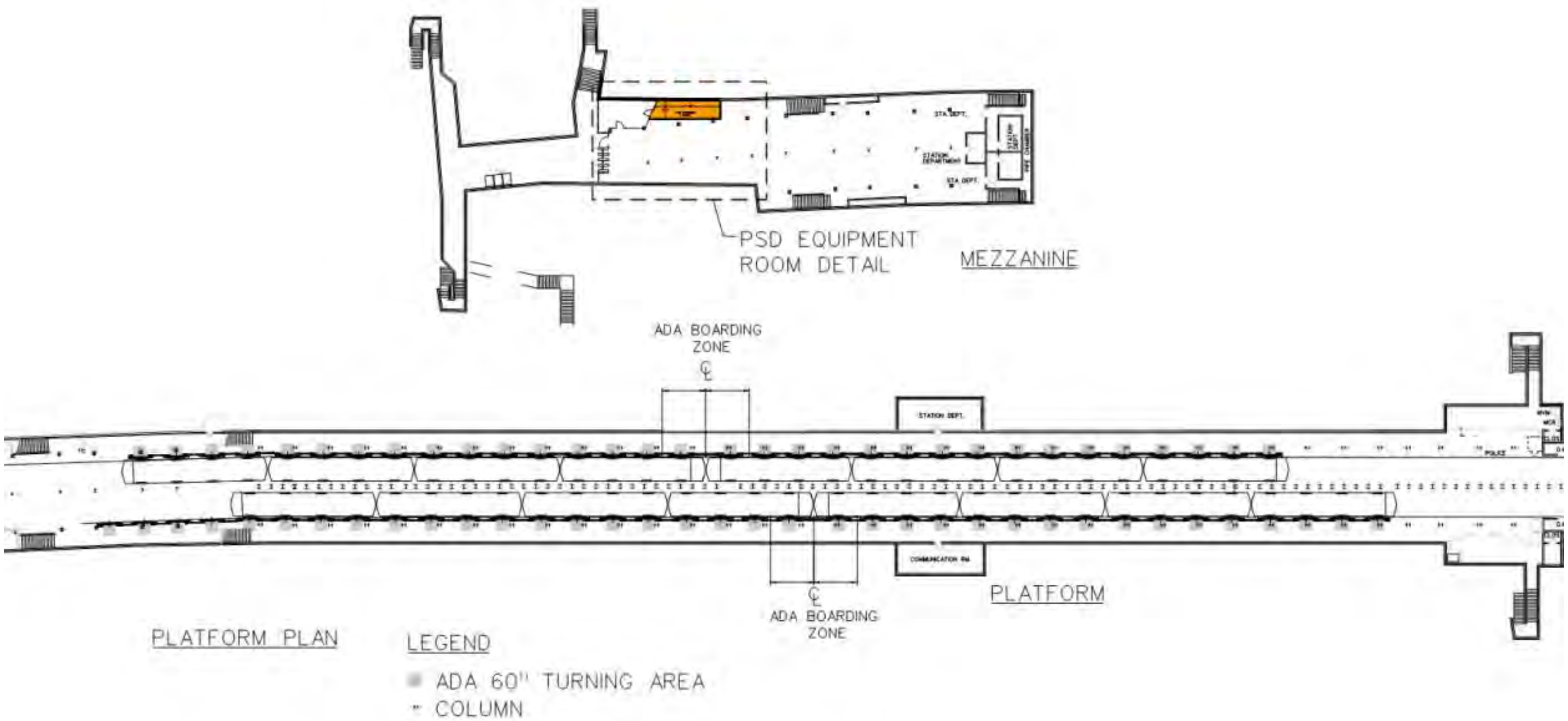


***Figure 1** – Station Plan*
MRN 283: Greenpoint Avenue
Note: Since currently the 'G' line runs a 4 car consist, accurate measurements could not be obtained for train stopping locations. As such the train locations shown on this report are approximated to center each 8 car consist on its respective platform

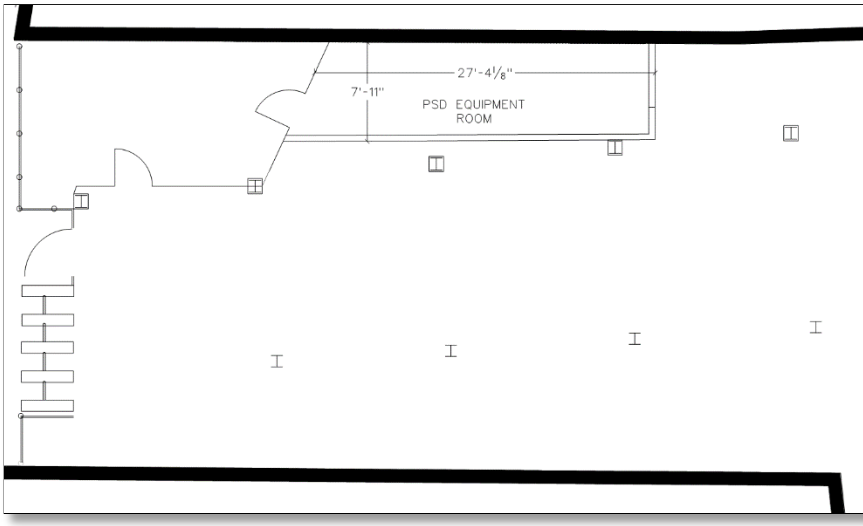


***Figure 2** – PSD Equipment Room Detail*
MRN 283: Greenpoint Avenue

Platform obstructions within 5' of edge:

Southbound Track:

- Columns
- Freestanding monitors

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:
Existing electrical service has adequate capacity to support the implementation of a APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Greenpoint Ave Manhattan Ave.
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	74.4
Apparent Power (kVA)	93.0
Station Peak Demand Load, Max Current, (A)	258.3
Maximum Amount of Doors	64.0
PSD Total Load Including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	423
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	377
Is Electrical Service Adequate?	**YES**
Notes	Service rating is based on the Field survey: 800 Amps (Fuse & Feeder)

Table 1 *–Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $30.4M to install APGs and $39.9M to install PSDs (See Appendix E)

***Figure 3** – Typical platform view with standpipe*
MRN 283 – Greenpoint Avenue

1.05 – MRN 284 | Nassau Avenue Station

Summary: *Nassau Avenue Station is feasible for both APGs and PSDs. Platform edge reconstruction will be required to support the requirements of an APG (see structural report; Appendix B). Electrical capacity at this station is adequate to support a APG/PSD system*

Description

Nassau Avenue Station is a below-grade station with two straight side platforms. The platform structure is cast-in-place concrete. Back-of-house elements are located throughout the platform level either in non-public rooms or at the platform ends away from the circulation paths. Columns are spaced 15’-0” on center with column faces approximately 3’-5” from the platform edge. Typically, the platform widths are approximately 11’-8”. Ceiling heights measure no less than 7’-6” throughout. Please see Figure 1 for overall station plan, Figure 2 for an enlarged room location and Figure 3 for a typical platform view.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. The varying ceiling heights throughout the station.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located on the Southbound Platform (To Brooklyn) adjacent to Control Area N406. The proposed room dimension is 27’-0” x 7’-0” (see Figure 1 & Figure 2 for reference)

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 2. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

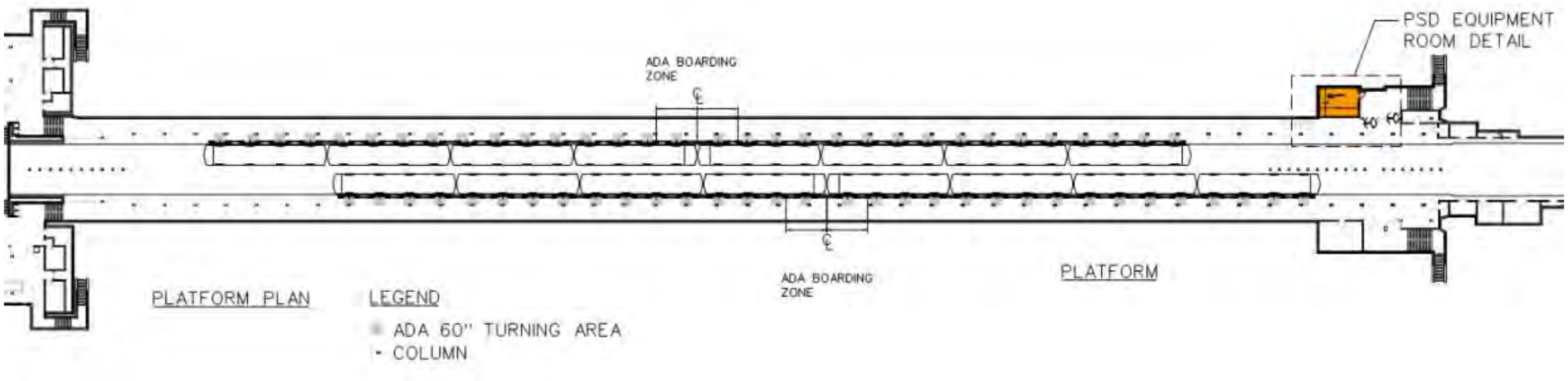


Figure 1 *– Station Plan*
MRN 284: Nassau Avenue

Note: Since currently the 'G' line runs a 4 car consist, accurate measurements could not be obtained for train stopping locations. As such the train locations shown on this report are approximated to center each 8 car consist on its respective platform

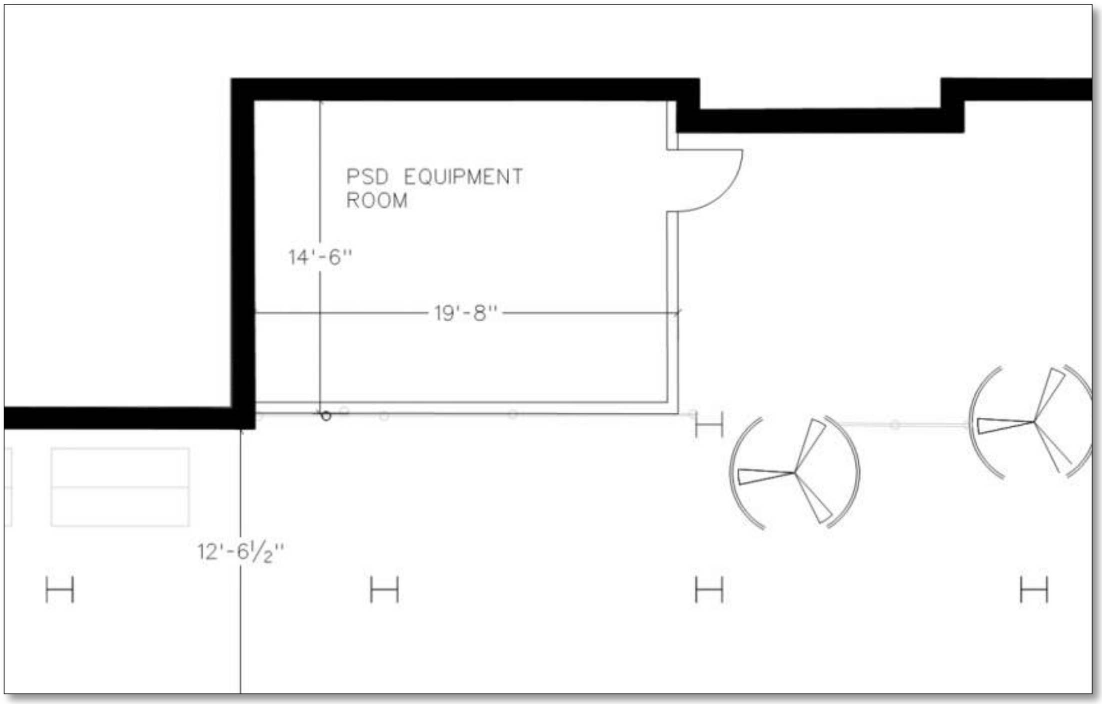


Figure 2 *– PSD Equipment Room Detail*
MRN 284: Nassau Avenue

Platform obstructions within 5' of edge:

Southbound Track (To Brooklyn):

- Columns

Northbound Track (To Queens):

- Columns
- Freestanding monitors

These obstructions do not present an impediment to the installation of PSDs

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:
Existing electrical service has adequate capacity to support the implementation of a APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station. MRN 284 has adequate capacity to support the implementation of a APG/PSD system.

Station
Power Capacity Analysis

Station Name	Nassau Ave
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	58.4
Apparent Power (kVA)	73.0
Station Peak Demand Load, Max Current, (A)	202.8
Maximum Amount of Doors	64.0
PSD Total Load Including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	368
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	432
Is Electrical Service Adequate?	**YES**
Notes	Service rating is based on the Field survey: 800 Amps (Fuse & Feeder)

Table 1 *– Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $30.8M to install APGs and $41.1M to install PSDs (See Appendix E)

Figure 3 *– Typical platform view*
MRN 284: Nassau Avenue

1.06 – MRN 285 | Metropolitan Avenue

Summary: *Metropolitan Avenue is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch-point width requirement for ADA complaint wheelchair movement would not be met at the platform edge adjacent the southernmost staircase on both platforms as the remaining width would be 27" (see Figure 1).*

Description

Metropolitan Avenue Station is a below-grade station with two side platforms. The platform structures are cast-in-place concrete. The width of both platforms is approximately 11'-4" throughout. There are three staircases along each platform. Columns are typically spaced 15' on center with column faces typically 3'-6" away from all platform edges. Passengers requiring an ADA-compliant path of travel can currently move along any area on both platforms. The implementation of a platform edge barrier would reduce existing widths below the required minimum of 32" for pinch-points at the platform edge adjacent to the southernmost staircase on both platforms. Currently the columns adjacent to the southernmost staircases are 42" measured column face to platform edge. If a PSD System is implemented the remaining 27" would not allow for ADA compliant wheelchair movement. Please see Figure 1 for reference.

Figure 1 *– Non-Compliant ADA condition at the platform edge adjacent to southernmost staircase on the southbound platform MRN 285: Metropolitan Avenue*

1.07 – MRN 286 | Broadway Union Avenue

Summary: Broadway Union Avenue station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch-point width requirement for ADA complaint wheelchair movement would not be met at platform edges adjacent to all staircases as the remaining width would be 23" (see Figure 1).

Description

Broadway Union Avenue Station is a below-grade station with two side platforms. The platform structures are cast-in-place concrete. The width of both platforms is approximately 11'-2" throughout. There are two staircases along each platform. Columns are typically spaced 15' on center with column faces typically 3'-2" away from all platform edges. Passengers requiring an ADA-compliant path of travel can currently utilize the corridor between the platform edge and the column faces. The implementation of a platform edge barrier would reduce existing widths below the required minimum of 32" for pinch-points at the platform edges adjacent to all platform level staircases. Currently the staircases are flanked by typical columns on the side adjacent to the platform edge. If a PSD System is implemented the remaining 23" would not allow for ADA compliant wheelchair movement. Please see Figure 1 for reference.

***Figure 1** – Non-Compliant ADA condition at the platform edge adjacent to staircase P3 on the southbound platform MRN 286: Broadway Union Avenue*

1.08 – MRN 287 | Flushing Avenue Station

Summary: *Flushing Avenue is feasible for both APGs and PSDs. Platform edge reconstruction will be required to support the requirements of an APG or PSD system (see structural report; Appendix B). Electrical capacity at this station is adequate to support a APG/PSD system*

Description

Flushing Avenue Station is a below-grade station with two straight side platforms. The platform structure is cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 3'-4" from the platform edge. The platform widths vary from approximately 11'-8" to 17'8". Ceiling heights measure no less than 7'-6" throughout. Please see Figure 1 for overall station plan, Figure 2 for an enlarged room location and Figure 3 for a typical platform view.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. The varying ceiling heights throughout the station.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located on the Northbound-bound platform adjacent to the Control Area N414. The proposed room dimension is 27'-0" x 7'-0" (see Figure 1 & Figure 2 for reference)

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

Platform edge reconstruction would be required for the installation of an APG or PSD system due to the current platform edge condition rating. The 2012 NYCT conditions survey gave the platform edges an average rating of 2.75. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

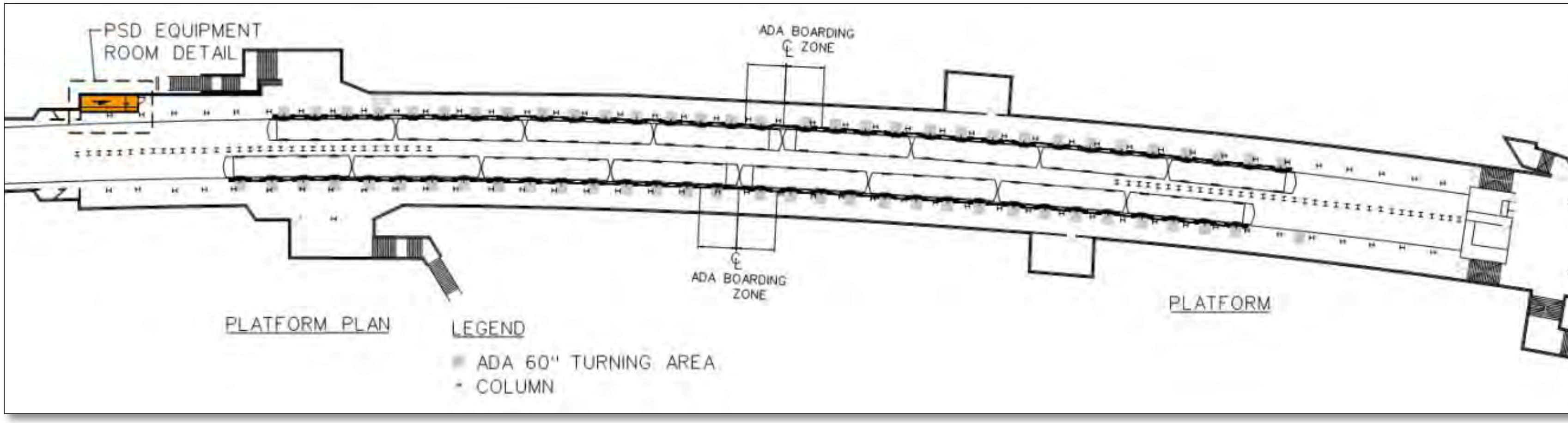


***Figure 1** – Station Plan*
MRN 287: Flushing Avenue Station

Note: Since currently the 'G' line runs a 4 car consist, accurate measurements could not be obtained for train stopping locations. As such the train locations shown on this report are approximated to center each 8-car consist on its respective platform

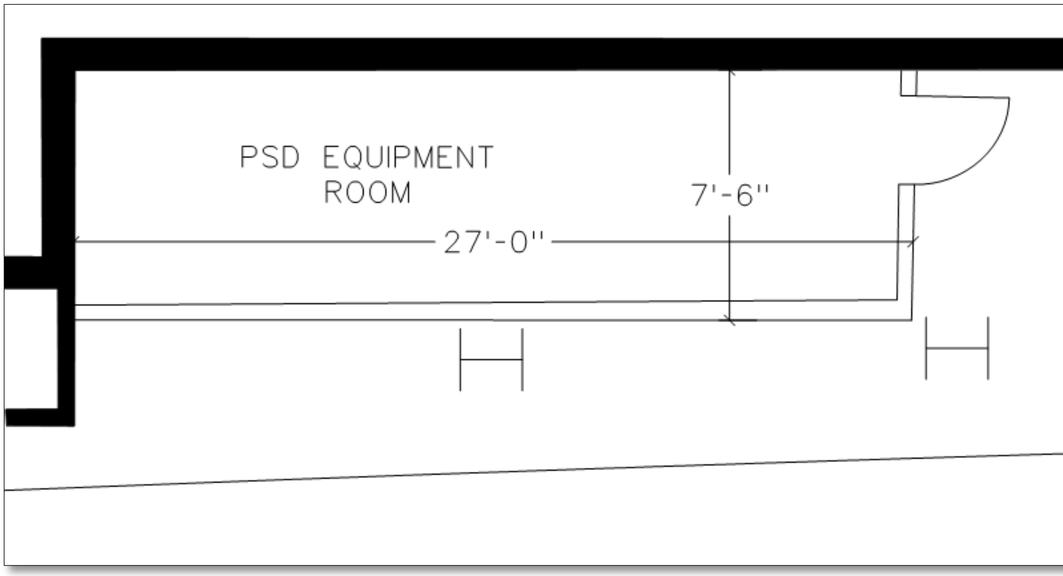


Figure 2 – *PSD Equipment Room Detail*
MRN 287: Flushing Avenue Station

Platform obstructions within 5' of edge:

Southbound Track (To Brooklyn):

- Columns
- Freestanding Monitor

Northbound Track (To Queens):

- Columns

These obstructions do not present an impediment to the installation of PSDs

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

Existing electrical service has adequate capacity to support the implementation of a APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Flushing Avenue Marcy Ave.
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	55.2
Apparent Power (kVA)	69.0
Station Peak Demand Load, Max Current, (A)	191.7
Maximum Amount of Doors	64.0
PSD Total Load Including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	357
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	443
Is Electrical Service Adequate?	**YES**
Notes	Service rating is based on the Field survey: 800 Amps (Fuse & Feeder)

***Table 1** – Power Capacity Analysis*

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $30.6M to install APGs and $39.3M to install PSDs (See Appendix E)

***Figure 3** – Typical platform view with MRN 287 – Flushing Avenue Station*

1.09 – MRN 288 | Myrtle Willoughby Street Station

Summary: *Myrtle Willoughby Street station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum requirement for ADA complaint wheelchair movement would not be met at the all underpass stairs (see figure 1).*

Description

Myrtle Willoughby Streets Station is a below-grade station with two straight side platforms. The platform structure is cast-in-place concrete. The width of both platforms varies from 13'-4" to 17-'4" throughout. There are four staircases along each platform, two of which lead to the underpass and do not allow for the 32" pinch-point width required for wheelchair movement with PSDs installed. Columns are spaced 15' on center with column faces 3'-4" away from all platform edges. Passengers requiring an ADA-compliant path of travel can currently move along the platform in the 3'-4" between columns and the platform edge. The implementation of a platform edge barrier would reduce this width at the underpass stairs below the required minimum of 32 for pinch-points". The remaining 25" would not allow for ADA compliant wheelchair movement. Please see Figure 1 for reference.

Figure 1 *– Non-Compliant ADA condition at the platform edge adjacent to the underpass stairs*
MRN 288: Myrtle Willoughby Streets Station

1.10 – MRN 289 | Bedford Nostrand Avenue Station

Summary: *Bedford Nostrand Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 33" (see figure 1). This condition occurs at all stairs on both sides of each platform throughout the station.*

Description

Bedford Nostrand Avenue station is a below-grade station with two straight center/island platforms. The platform structure is cast-in-place concrete. The width of both platforms is approximately 13'-8" throughout. There are six staircases along each platform, all of which would not allow for the 36" width required for wheelchair movement with PSDs installed. Columns are spaced 15' on center with column faces 6'-4" away from all both platform edges. The stairs are centered on the platform. Staircases are not flanked by typical station columns, rather the columns are situated along the platform centerline, in line with the staircases. The staircases are 4' away from both platform edges. Passengers requiring an ADA-compliant path of travel can currently move anywhere along the platform. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 33" would not allow for ADA compliant wheelchair movement.

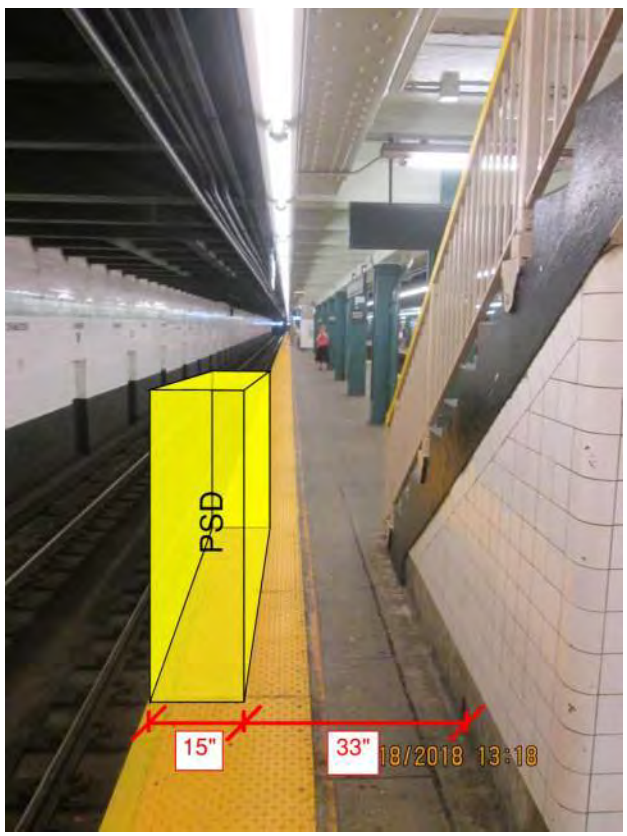


Figure 1 *– Non-Compliant ADA condition at the platform edge by a staircase*
MRN 289: Bedford Nostrand Avenue Station

1.11 – MRN 290 | Classon Avenue Station

Summary: *Classon Avenue is feasible for both APGs and PSDs. There is a continuous standpipe running through multiple locations of the southbound platform edge (see Figure 3). This standpipe would likely need to be relocated in the implementation of a full height PSD system. Platform edge reconstruction will be required to support the requirements of an APG (see structural report; Appendix B). Electrical capacity at this station is adequate to support a APG/PSD system*

Description

Classon Station is a below-grade station with two straight side platforms. The platform structure is cast-in-place concrete. Columns are spaced 15’-0” on center with column faces approximately 3’-4” from the platform edge. Typically, the platform widths are approximately 11’-4”. On the southbound platform there is a continuous standpipe running through multiple locations of the platform edges. This standpipe would likely need to be relocated in the implementation of a full height PSD system. Ceiling heights measure no less than 7’-6” throughout. Please see Figure 1 for overall station plan, Figure 2 for enlarged room location and Figure 3 for a typical platform view.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. The varying ceiling heights throughout the station. Present Standpipe on southbound platform would need to be relocated in the implementation of full height PSDs (see figure 3).

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located on the east side of the mezzanine level adjacent to staircase P4. The proposed room dimension is 27’-0” x 7’-6” (see figure 1 & figure 2)

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 2. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

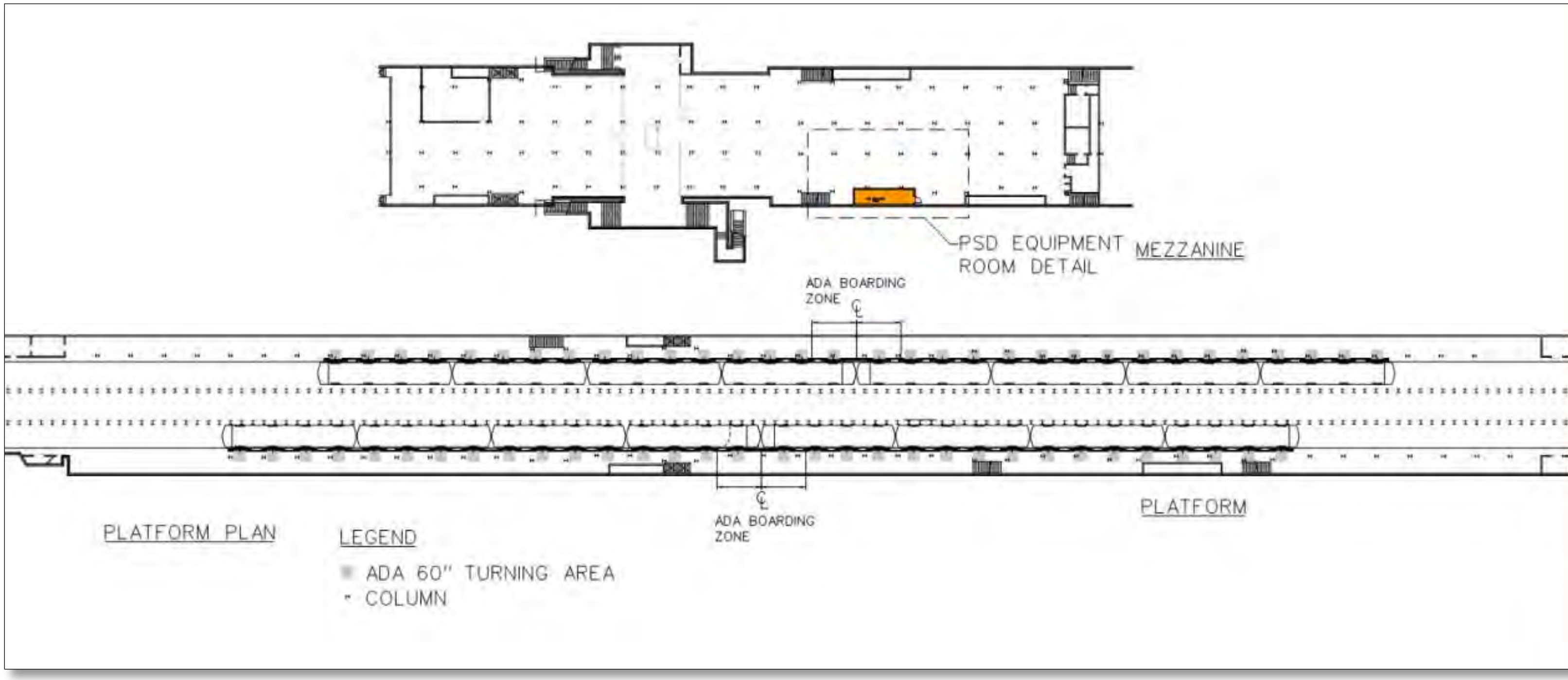


Figure 1 *– Station Plan*
MRN 290: Classon Avenue

Note: Since the 'G' line currently runs a 4 car consist, accurate measurements could not be obtained for train stopping locations. As such the train locations shown on this report are approximated to center each 8-car consist on its respective platform

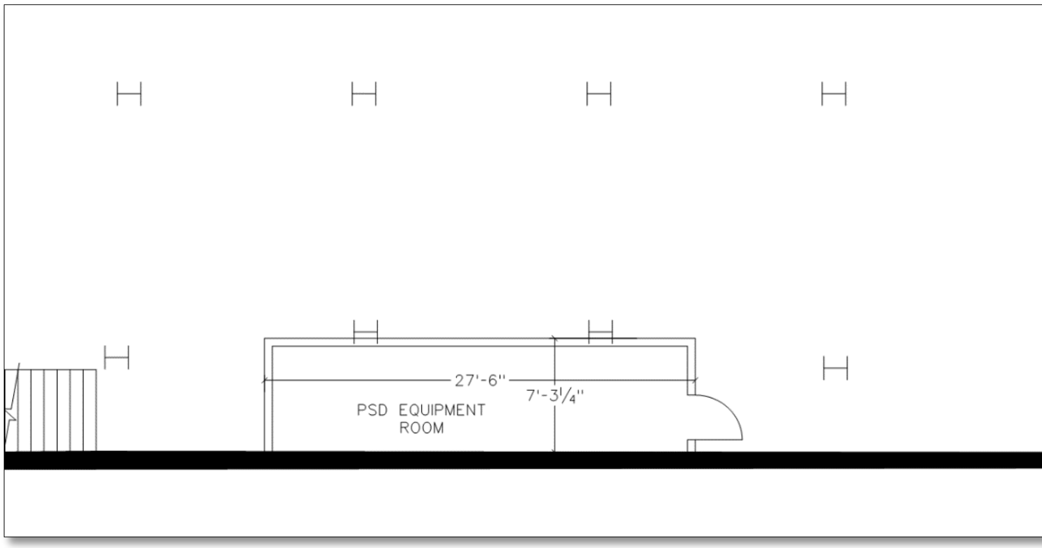


***Figure 2** – PSD Equipment Room Detail*
MRN 290: Classon Avenue

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

Existing electrical service has adequate capacity to support the implementation of a APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Classon Avenue
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	54.0
Apparent Power (kVA)	67.5
Station Peak Demand Load, Max Current, (A)	187.5
Maximum Amount of Doors	64.0
PSD Total Load Including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	353
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	448
Is Electrical Service Adequate?	**YES**
Notes	Service rating is based on the Field survey: 800 Amps (Fuse & Feeder)

Table 1 *– Power Capacity Analysis*

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $30.5M to install APGs and $39.4M to install PSDs (See Appendix E)

***Figure 3** – Typical platform view with standpipe*
MRN 290 – Classon Avenue Station

1.12 – MRN 291 | Clinton & Washington Avenues Station

Summary: *Clinton & Washington Avenues Station is feasible for both APGs and PSDs. There is a continuous standpipe running through multiple locations of the platform edges (see Figure 3). This standpipe would likely need to be relocated in the implementation of a full height PSD system. Platform edge reconstruction will be required to support the requirements of an APG (see structural report; Appendix B). Electrical capacity at this station is adequate to support a APG/PSD system*

Description

Clinton & Washington Avenues Station is a below-grade station with two straight side platforms. The platform structure is cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 3'-4" from the platform edge. Typically, the platform widths are approximately 11'-4". On both platforms there is a continuous standpipe running through multiple locations of the platform edges. This standpipe would likely need to be relocated in the implementation of a full height PSD system. Ceiling heights vary throughout the station, ranging from 7-0" to 7'-6". Please see Figure 1 for overall station plan, Figure 2 for enlarged room location and Figure 3 for a typical platform view.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. The varying ceiling heights throughout the station. Present Standpipe on both platforms would need to be relocated in the implementation of full height PSDs (see figure 3).

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located on the east side of the mezzanine level adjacent to staircase P7. The proposed room dimension is 27'-6" x 7'-0" (see figure 1 &* figure 2)

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 2. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

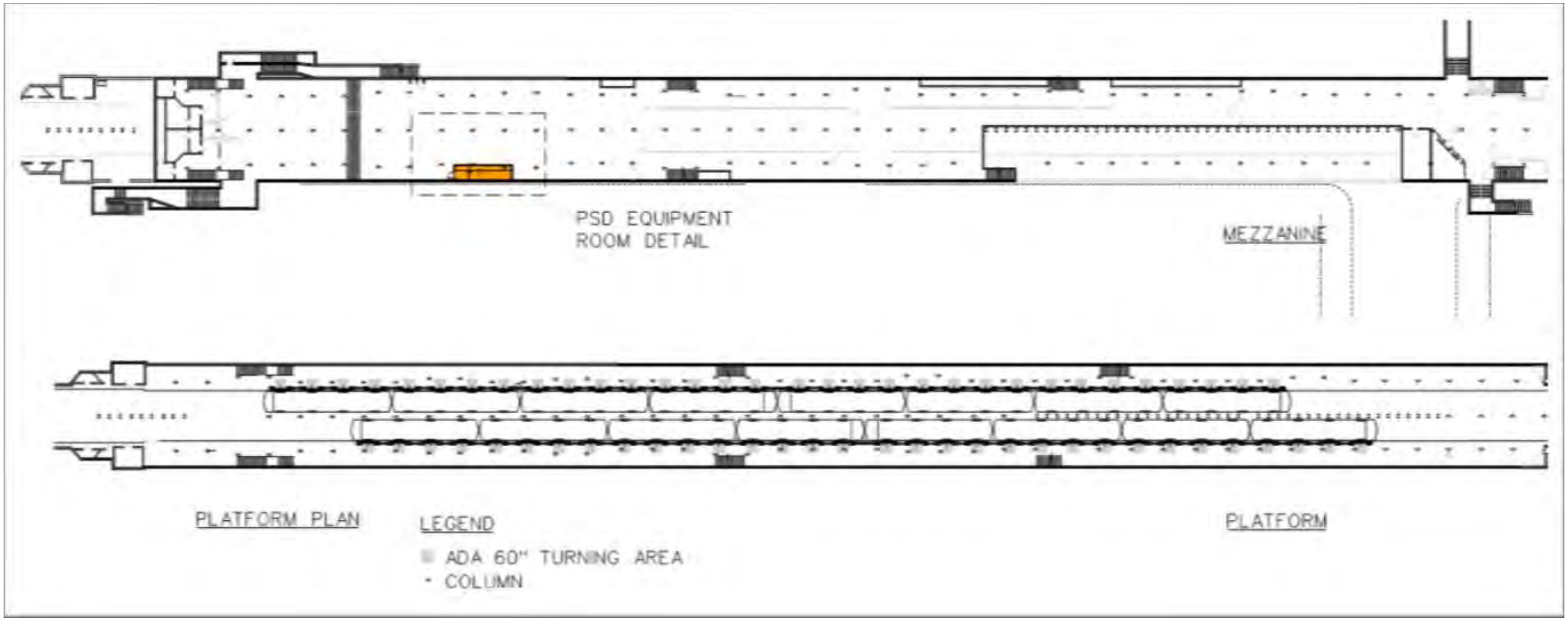


***Figure 1** – Station Plan*
MRN 291: Clinton & Washington Avenues

Note: Since currently the 'G' line runs a 4 car consist, accurate measurements could not be obtained for train stopping locations. As such the train locations shown on this report are approximated to center each 8-car consist on its respective platform

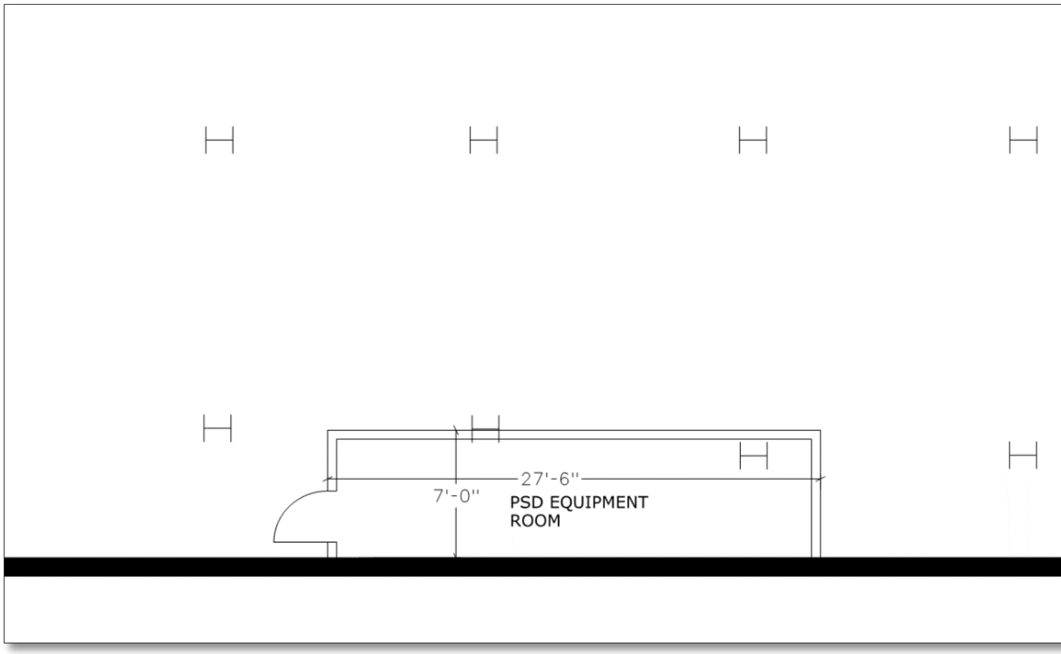


***Figure 2** – PSD Equipment Room Detail*
MRN 291: Clinton & Washington Avenues

Platform obstructions within 5' of edge:

Southbound Track:

- Columns
- Freestanding Monitors

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

Existing electrical service has adequate capacity to support the implementation of a APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Clinton & Washington Avenues
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	56.8
Apparent Power (kVA)	71.0
Station Peak Demand Load, Max Current, (A)	197.2
Maximum Amount of Doors	64.0
PSD Total Load Including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	362
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	438
Is Electrical Service Adequate?	**YES**
Notes	Service rating is based on the Field survey: 800 Amps (Fuse & Feeder)

***Table 1** –Power Capacity Analysis*

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $30.4M to install APGs and $39.3M to install PSDs (See Appendix E)

***Figure 3** – Typical platform view with standpipe & free-standing monitor*
MRN 291 – Clinton & Washington Avenues

1.13 – MRN 292 | Fulton Street Lafayette Avenue Station

Summary: *Fulton Street Lafayette Avenue is feasible for both APGs and PSDs. There is a continuous standpipe running through multiple locations of both platform edges (see Figure 3). This standpipe would likely need to be relocated in the implementation of a full height PSD system. On the northbound platform edge there are is also a ceiling mounted monitor located above the platform edge with a vertical clearance of 6'-8" and a signal light located above the platform edge with a vertical clearance of 7'-8" both of which would also require relocation. Platform edge reconstruction will be required to support the requirements of an APG or PSD system (see structural report; Appendix B). Electrical capacity at this station is adequate to support a APG/PSD system*

Description

Fulton Street Lafayette Avenue Station is a below-grade station with two straight side platforms. The platform structure is cast-in-place concrete. Columns are spaced 15'-0" on center with column faces typically 3'-4" from the platform edge. The platform widths vary from approximately 5'-6" to 20' 10". There is a continuous standpipe running through multiple locations of both platform edges (see Figure 3). This standpipe would likely need to be relocated in the implementation of a full height PSD system. On the northbound platform edge there are is also a ceiling mounted monitor located above the platform edge with a vertical clearance of 6'-8" and a signal light located above the platform edge with a vertical clearance of 7'-8" both of which would also require relocation. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. The varying ceiling heights throughout the station. Existing standpipe, ceiling mounted monitors & signals lights would need to be relocated in the implementation of full height PSDs (see figure 3)

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located on the northbound platform adjacent to the Transfer Closet. The proposed room dimension is 27'-0" x 7'-0" (see figure 2).

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

Platform edge reconstruction would be required for the installation of an APG or PSD system due to the current platform edge condition rating. The 2012 NYCT conditions survey gave the platform edges an average rating of 3.25 On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

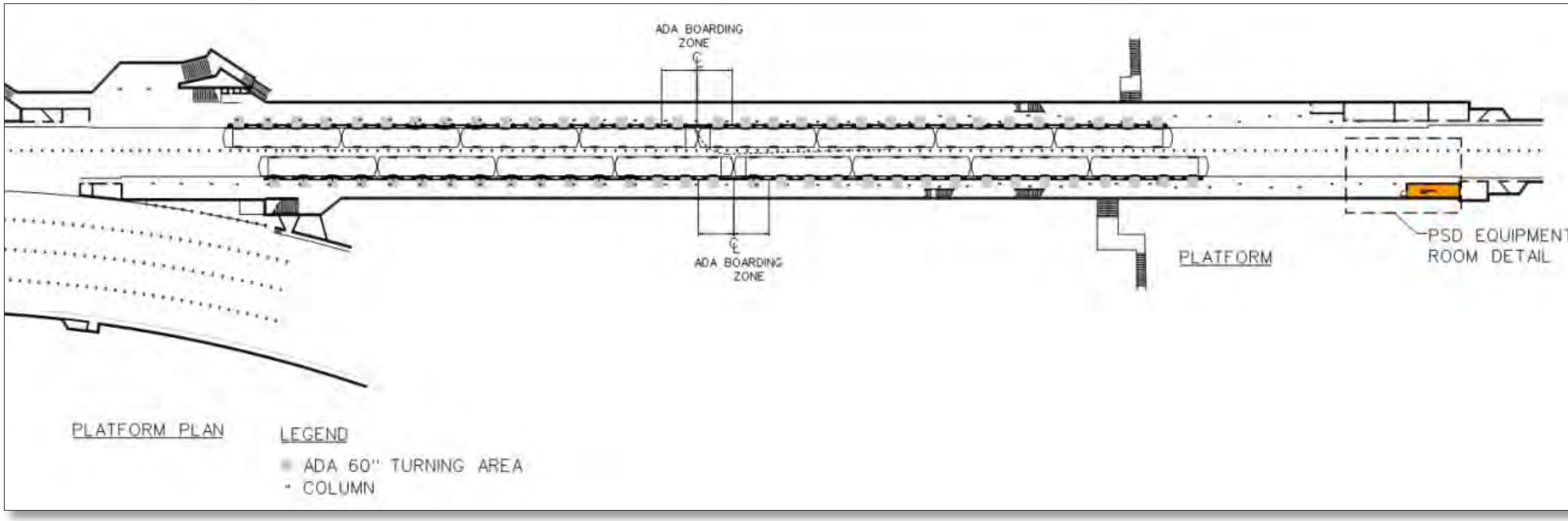


Figure 1 *– Station Plan*
MRN 292: Fulton Street Lafayette Avenue Station

Note: Since currently the 'G' line runs a 4 car consist, accurate measurements could not be obtained for train stopping locations. As such the train locations shown on this report are approximated to center each 8-car consist on its respective platform

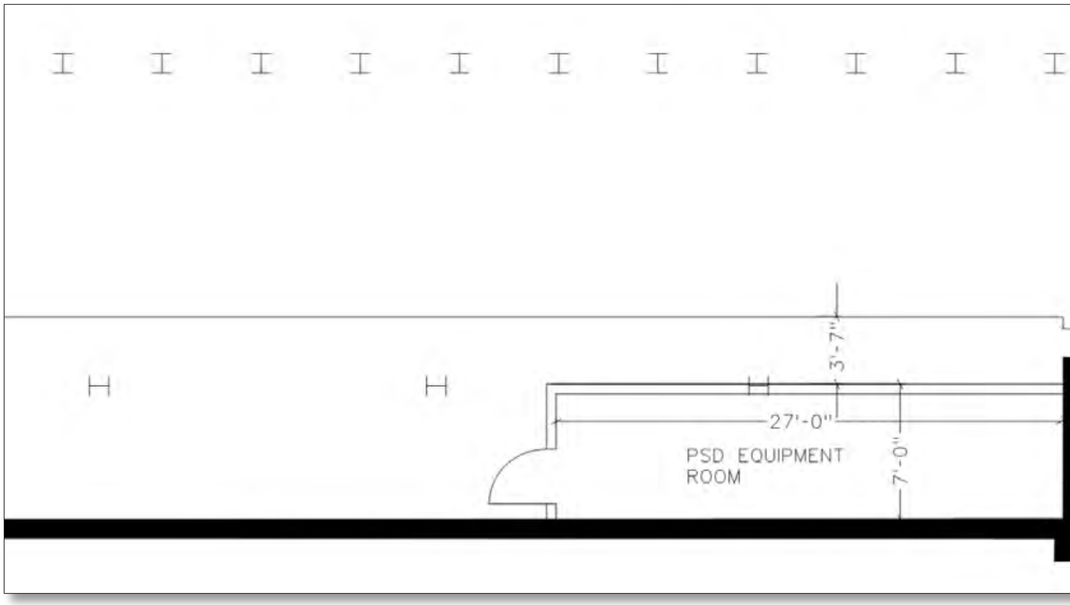


Figure 2 *– PSD Equipment Room Detail*
MRN 292: Fulton Street Lafayette Avenue

Platform obstructions within 5' of edge:

Southbound Track:

- Columns
- Freestanding monitors

Northbound Track:

- Columns
- Freestanding monitors

These obstructions do not present an impediment to the installation of PSDs

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

Existing electrical service has adequate capacity to support the implementation of a APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Fulton Street Lafayette Ave
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	69.8
Apparent Power (kVA)	87.3
Station Peak Demand Load, Max Current, (A)	242.4
Maximum Amount of Doors	64.0
PSD Total Load Including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	407
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	393
Is Electrical Service Adequate?	**YES**
Notes	Service rating is based on the Field survey: 800 Amps (Fuse & Feeder)

***Table 1** – Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $30.8M to install APGs and $40.6M to install PSDs (See Appendix E)

Figure 3 *– Typical platform view with standpipe*
MRN 292: Fulton Street Lafayette Avenue

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for <u>Tier 2 Stations'</u> screening will include the following:*
>
> - *a. Column location in relation to the platform edge*
> - *b. Platform edge clearance adjacent to stairs and other impediments*
> - *c. Impacts to ADA path of travel and boarding areas*
> - *d. Conflicts of PSD/APG/RPSDs with Signals cables*
> - *e. Sufficient platform width*
> - *f. Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for <u>Tier 3 Stations</u> will include the following:*
>
> - *a. Structural capacity of platforms to accept PSD/APG/RPSDs*
> - *b. Feasibility & location for PSD/APG/RPSDs equipment room*
> - *c. Confirmation of adequate power for PSD/APG/RPSDs*
> - *d. Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> - *e. Determination of communications requirements, availability and cost*
> - *f. Determination of gap detection and entrapment avoidance technology requirements*
> - *g. Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
    - Double the amount of motors as PSDs (each motor operating a single leaf).
    - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
    - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
    - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY. Status of doors will be provided to crew via indicator lights, with no automated propulsion cutout.

If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	**Dedicated Loop**	**Wayside Only**
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

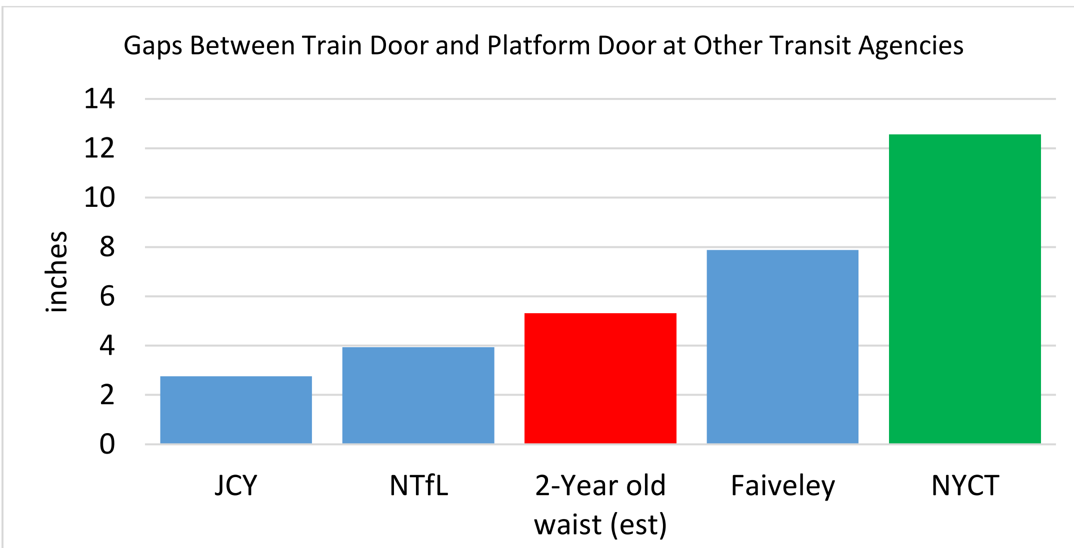


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

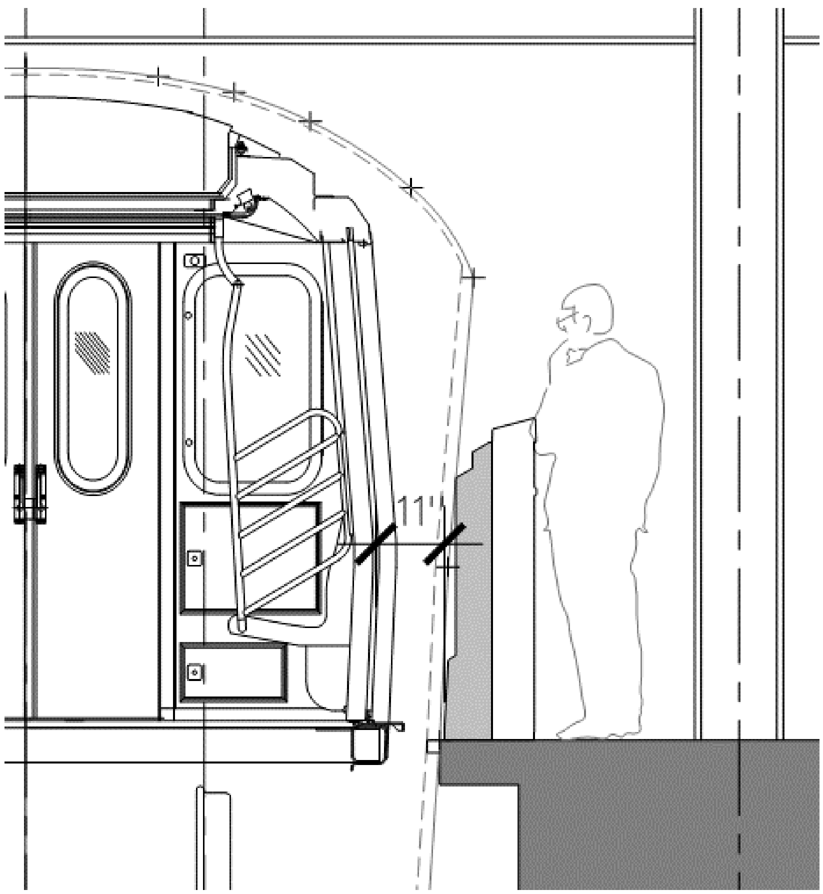


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber "bumpers" on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6" into the line equipment envelope. This would leave a 5" gap between the platform and car doors allowing approximately 2" of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5" by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor's window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor's window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **<u>bold/underline</u>**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	PSD System 1	PSD System 2	PSD System 3
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are “existing” as defined by code. All the rolling stock is also to be considered “existing” under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60” radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36” of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

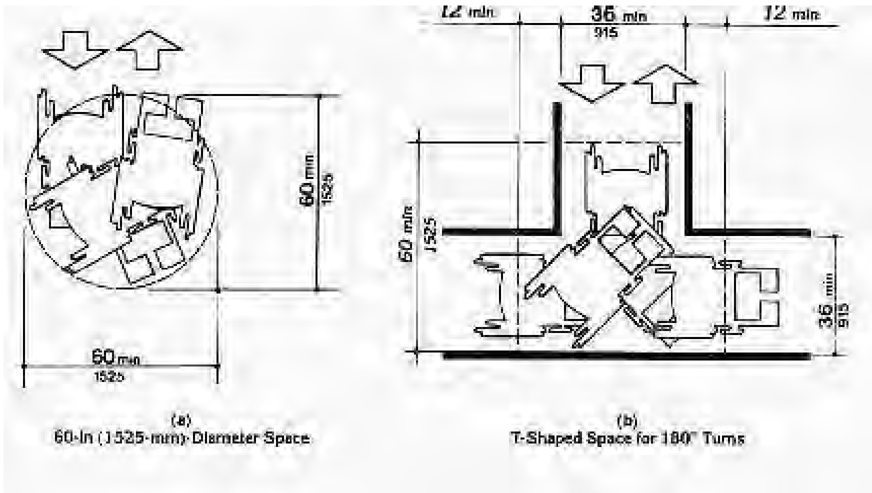
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

> *Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.*

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

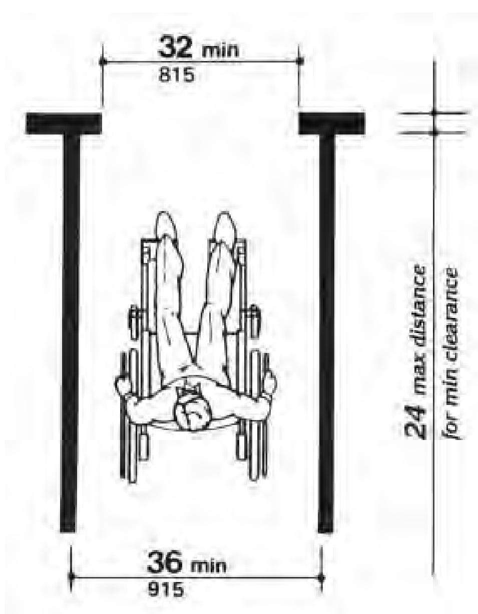


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as “existing”; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60” turning radius in which to make this turn. (the “T” shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an “alteration to the path of travel”, requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32” point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

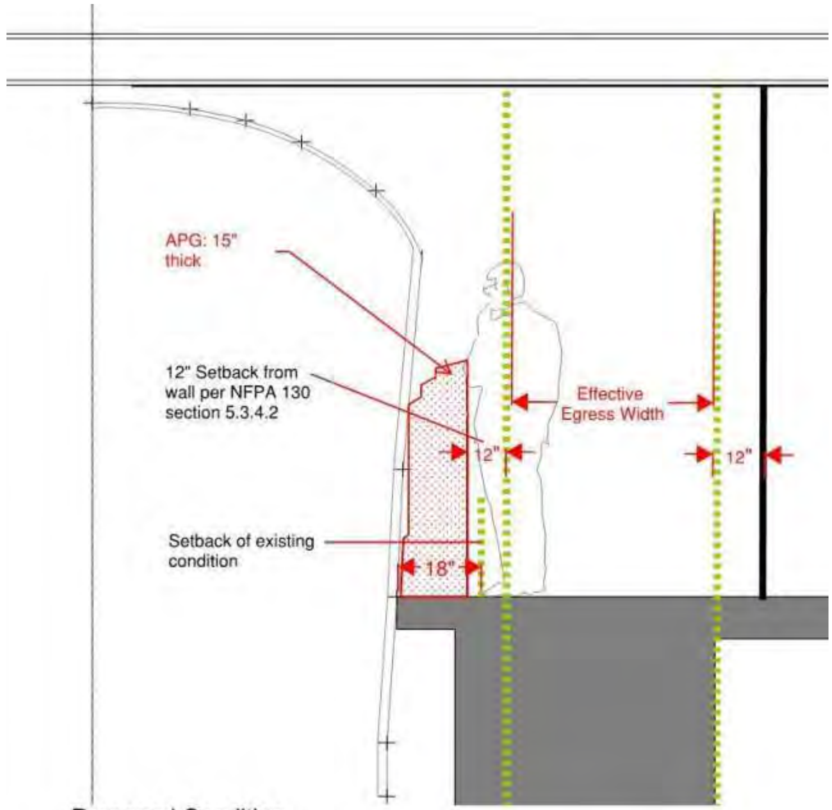
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15" of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

Table of Contents

Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

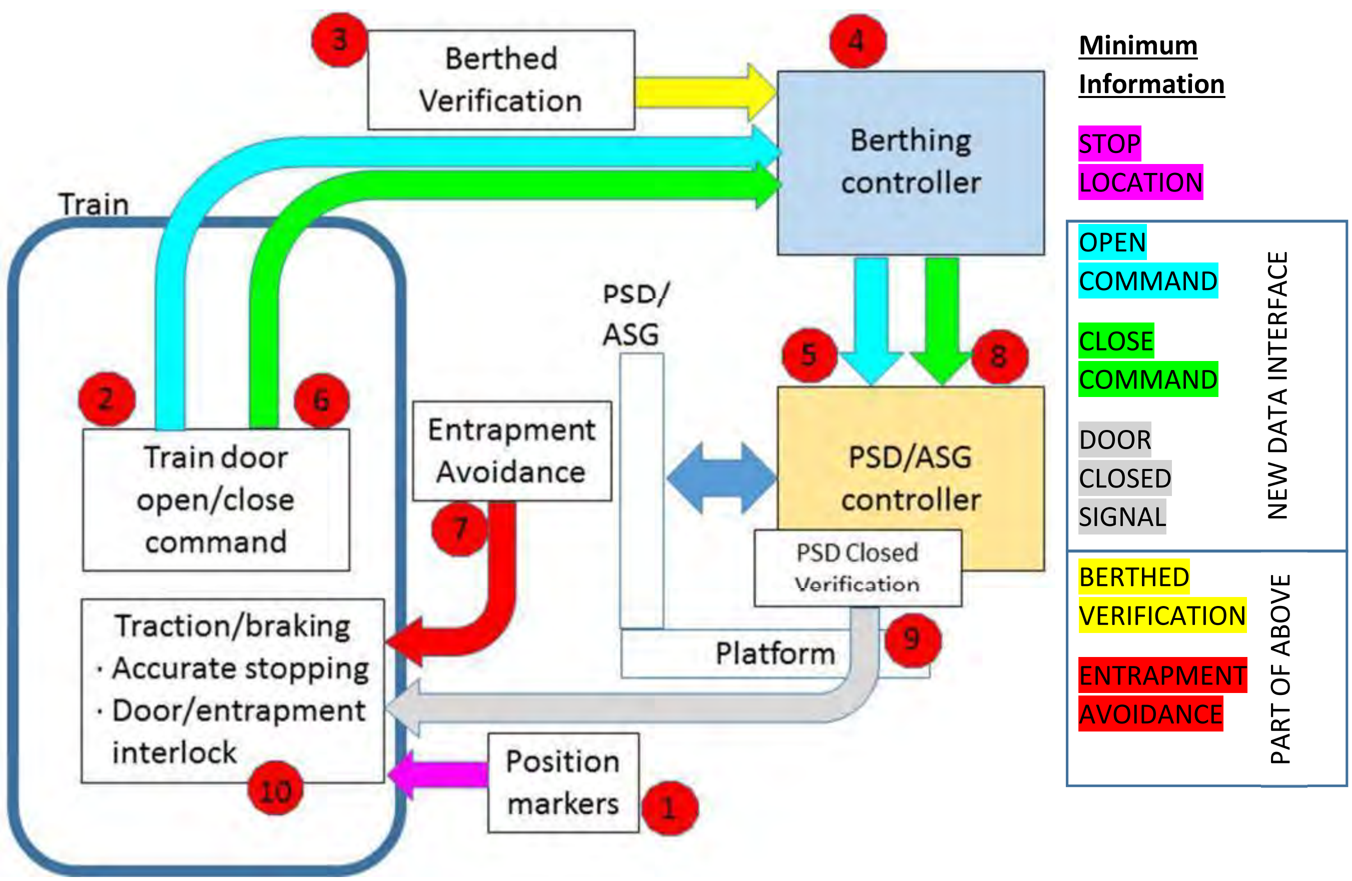
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

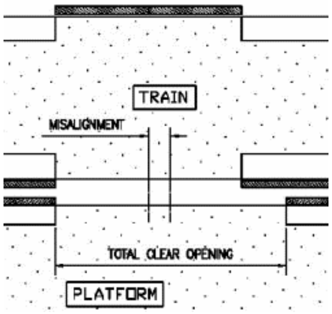
C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5" clear opening, a design for NY should meet the ADA Accessibility Guideline of 36".

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a 'distance totem' which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy's COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

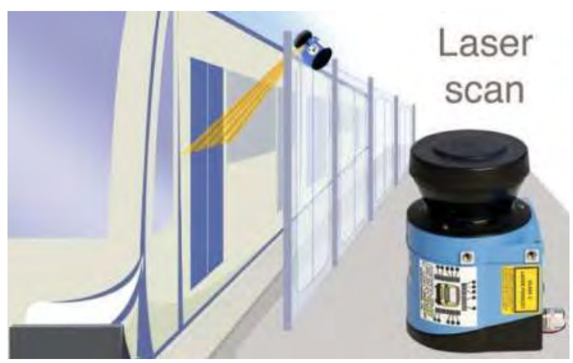
Dedicated Loop

The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically



If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.

For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

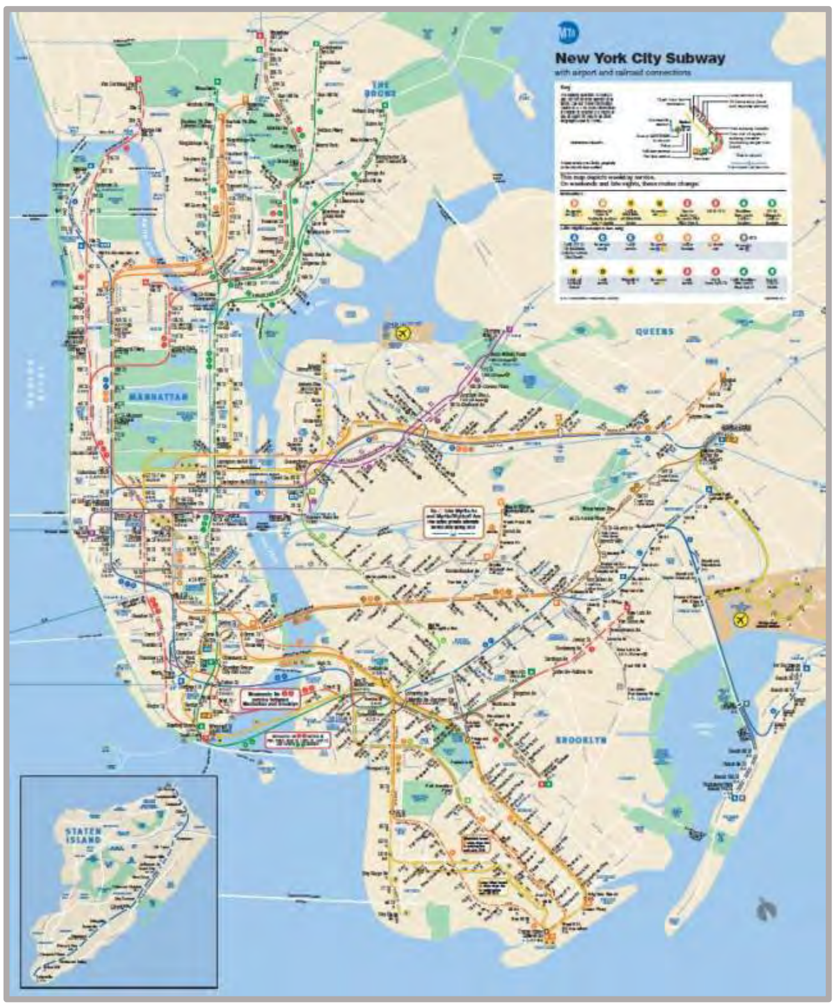


Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4'-0"). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

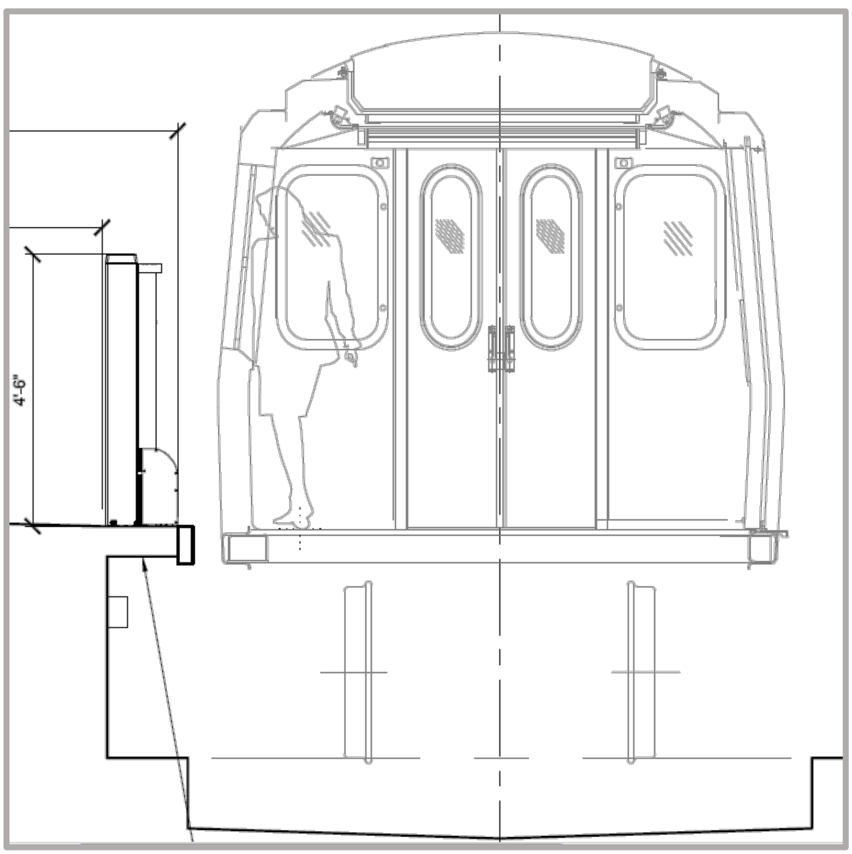


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

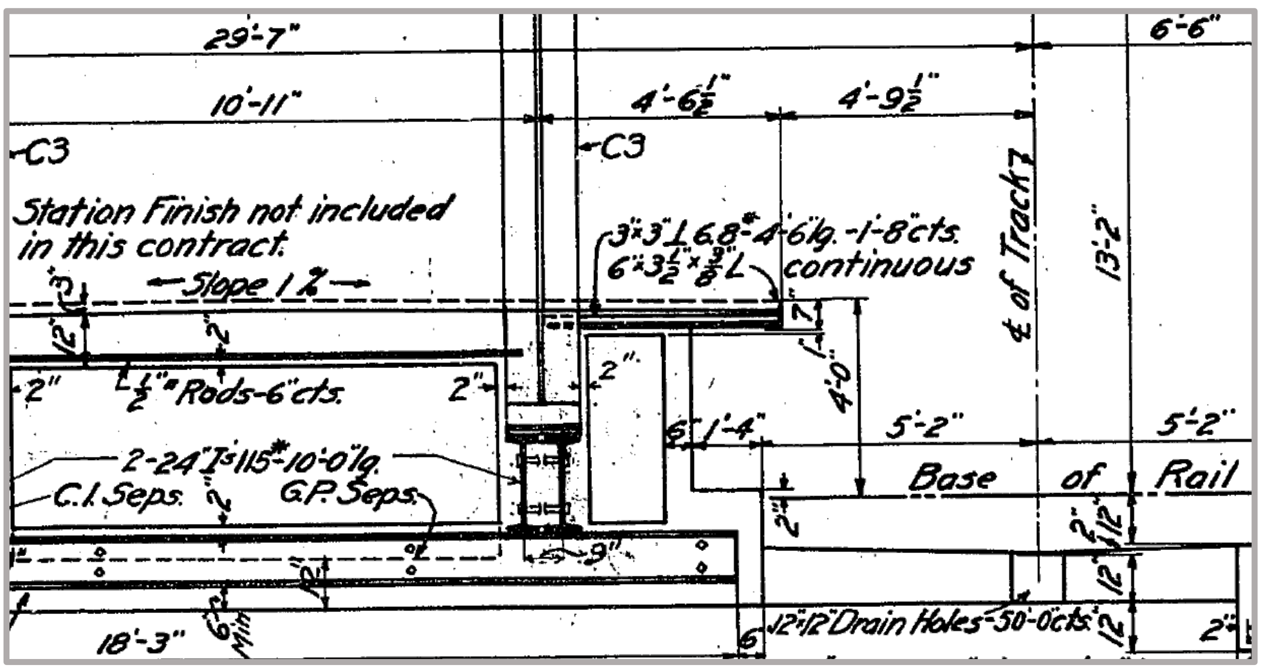


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

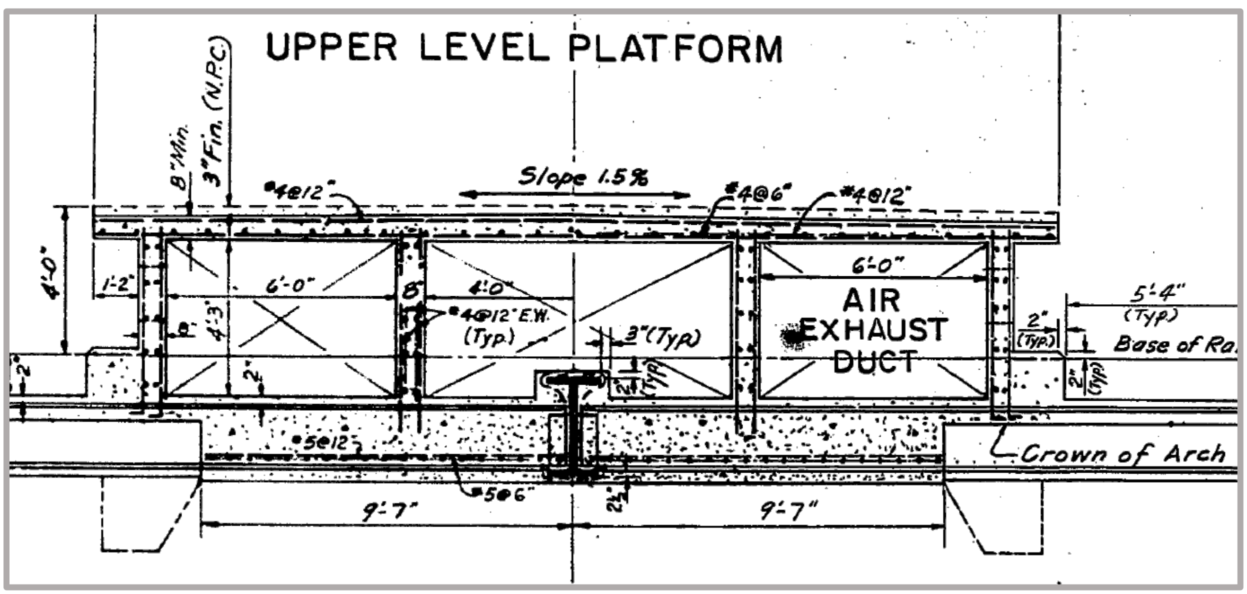


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

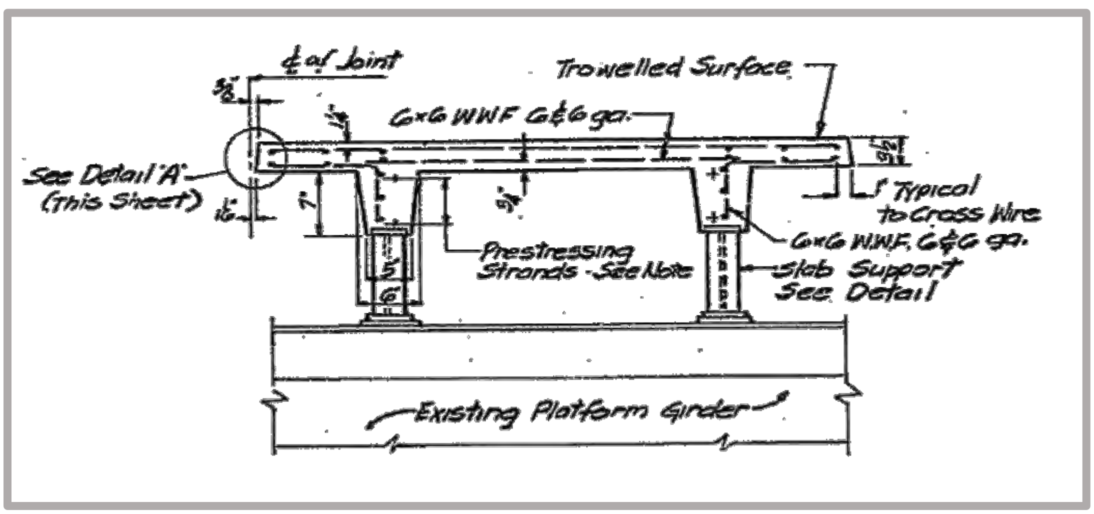


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

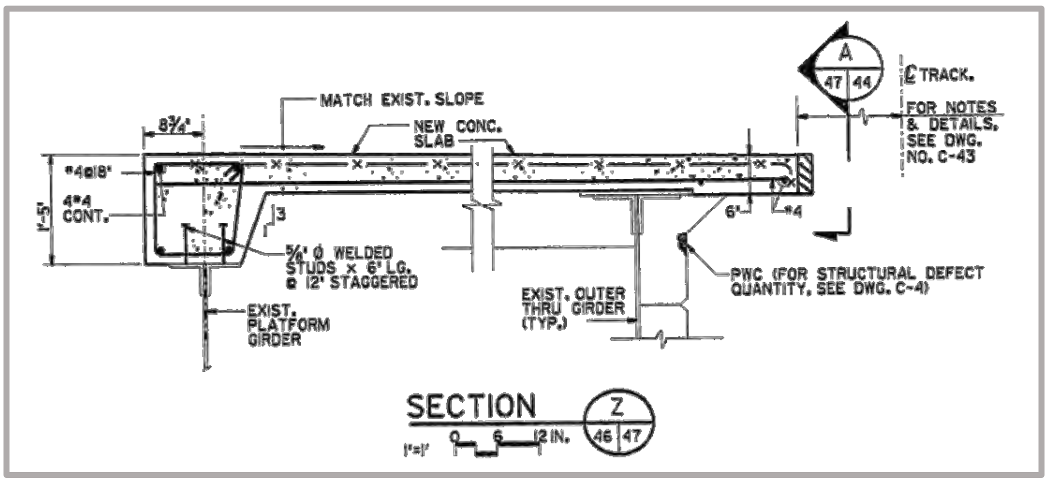


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2’-9”), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

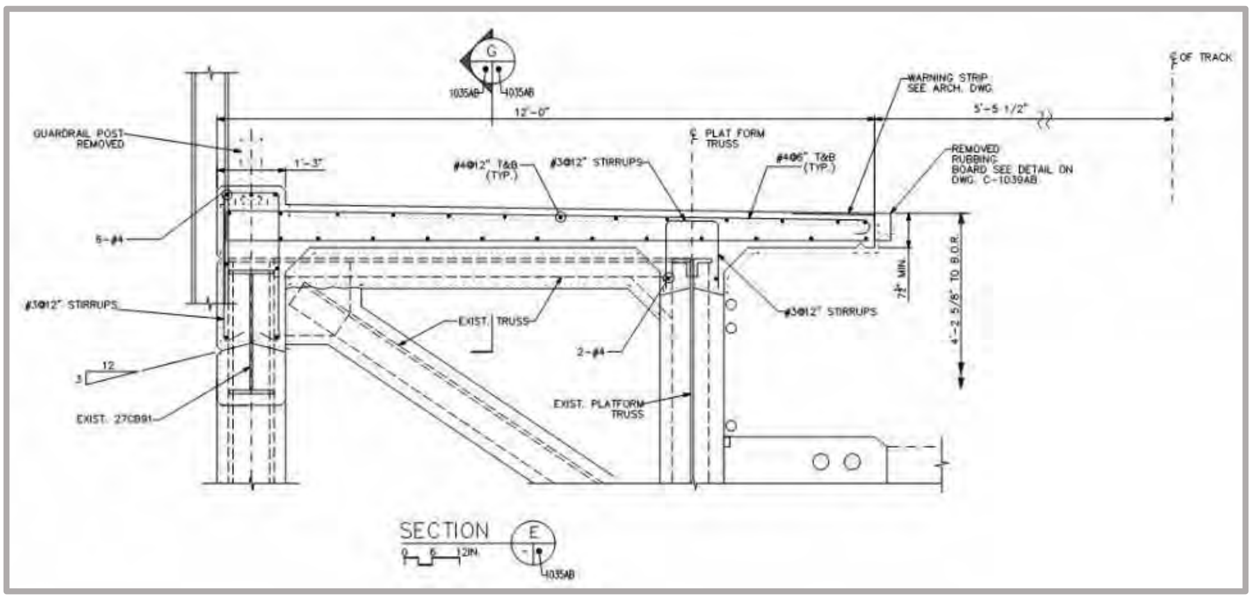


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3" thick structural slab with an approximately 3" thick topping slab. If the topping slab is fully removed, a 6" thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6" thick slab will be sufficient for a cantilever length of up to approximately 3'-0", greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6" structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6" minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

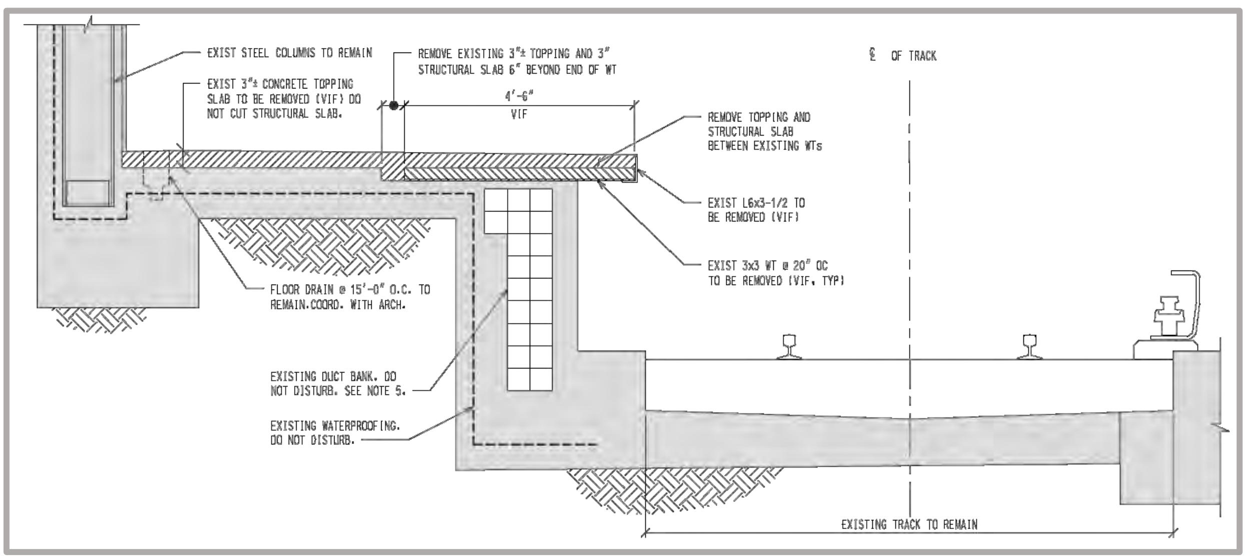


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

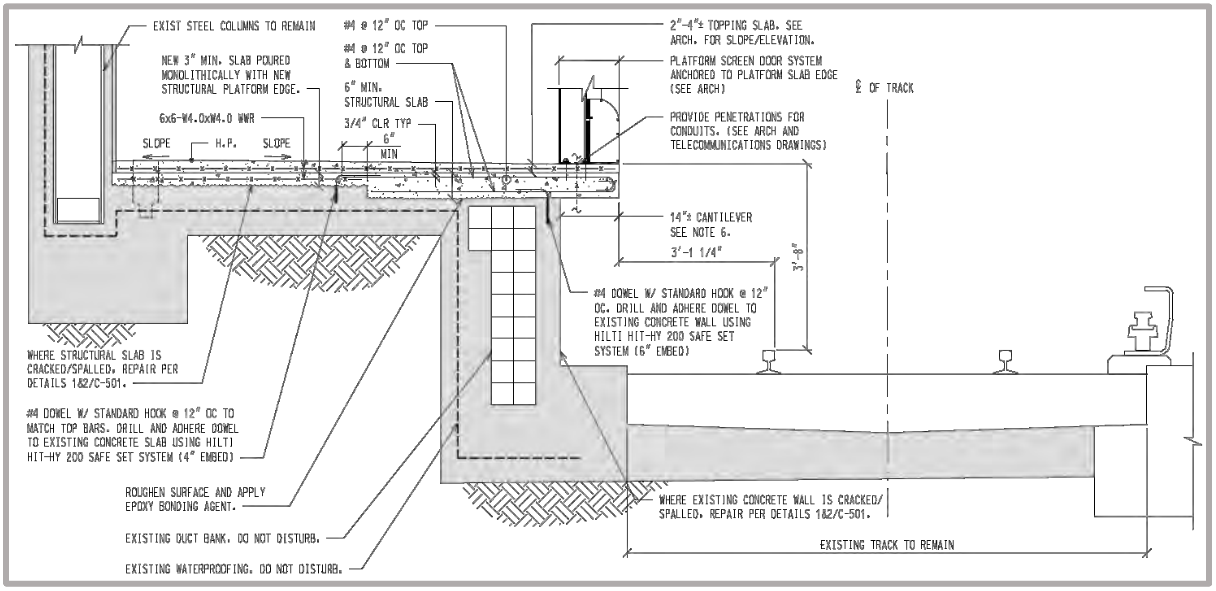


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

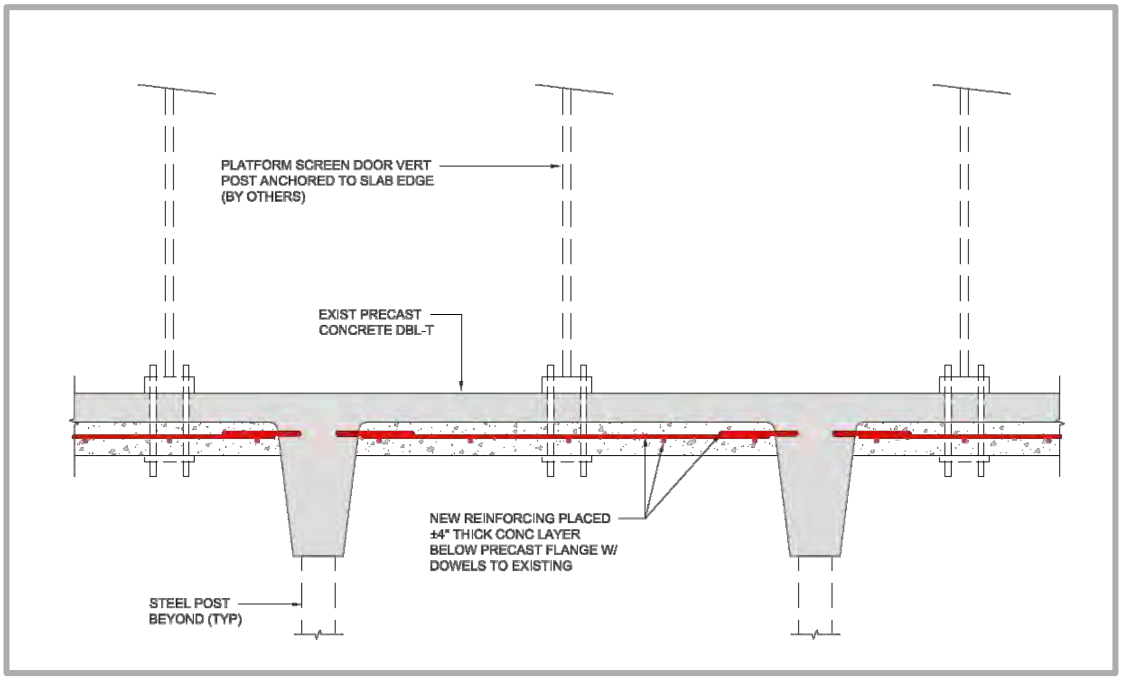


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5' – 11" of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis

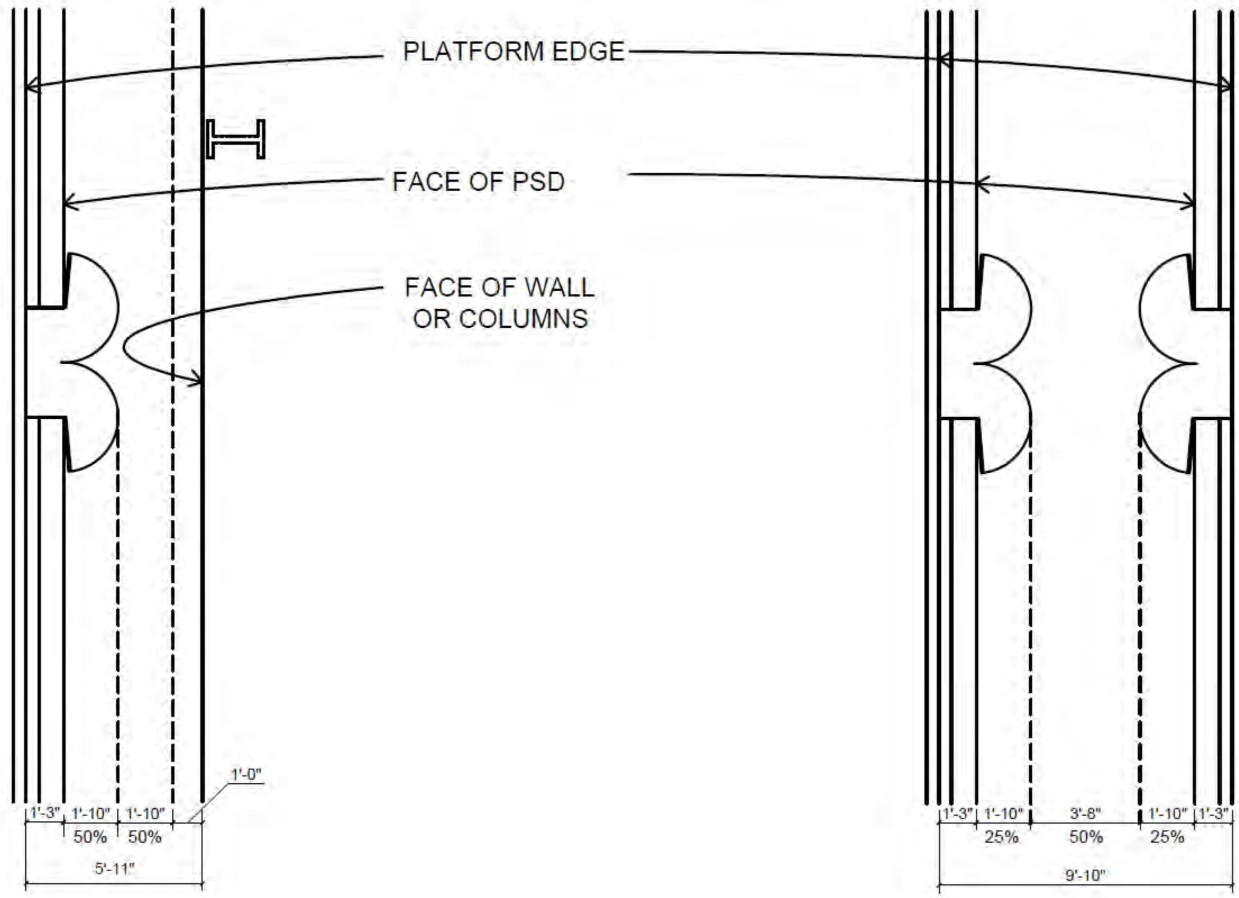


FIGURE 1: SIDE PLATFORM

FIGURE 2: CENTER PLATFORM

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE		EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800	per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	9	$ 63,500	per month [Year 01]	$ 571,500		
		12	$ 83,590	per month [Year 02]	$ 1,003,080		
		12	$ 65,683	per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000	per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5					
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment.	12	$ 68,310	per month [Year 04]	$ 819,724		$ 819,724
		12	$ 71,043	per month [Year 05]	$ 852,513		$ 852,513
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5					
	Repair and Replacement of Defective Hardware	24	$ 6,350	per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880	per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220	per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500	per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10					
	Repair and Replacement of Defective Hardware	60	$ 9,525	per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920	per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230	per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750	per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15					
	Repair and Replacement of Defective Hardware	60	$ 12,700	per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200	per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240	per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000	per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20					
	Repair and Replacement of Defective Hardware	60	$ 15,875	per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500	per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250	per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500	per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]			TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)			TOTAL:	$ 7,619,663		

7	Labor Bill Rate (per hour)	Year 1	$ 238	per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248	per hour *	
		Year 3	$ 257	per hour *	
	Optional :	Year 4	$ 268	per hour *	
	Optional :	Year 5	$ 278	per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32514
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations
ESTIMATE DATE:	August 31, 2018

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations

MTA/NYCT

August 31, 2018

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs / PSDs will provide 31 emergency egress doors with push bars per platform*
1.2 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.3 *Each platform edge will have 40 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.2 In respect of the PSD option, only platforms that have not been upgraded in the recent past (assuming over the past two decades) will require platform edge replacement.
2.3 There are no special security requirements made necessary by installation of the APG system
2.4 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.5 This estimate does not provide for the replacement of Platform Edge Lighting
2.6 Premium cost for night time work is considered 50% of total labor cost

3.0 ***Exclusions - Costs not included in the estimate:***

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations

MTA/NYCT

August 31, 2018

BASIS OF ESTIMATE

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems

3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length

3.4 Costs associated with NYCT State Of Good Repair improvements to the station

3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.

3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs

3.7 Escalation Cost is not included; Anticipate at 5% per annum.

3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.

3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium

3.10 NYCT project cost is not included

3.11 GO and flagging cost is not included

3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 *Below the line or "soft" costs:*

4.1 Design and Construction Contingency

4.2 Contractor O & P

4.3 Insurance

4.4 NYCT project costs not included

5.0 *Additional Notes*

5.1 *Given the limited time available, no drawings were developed to support this estimate.*

MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations
IRT Flushing Line Stations

August 31, 2018

ORDER OF MAGNITUDE COSTS			MR-283	MR-284	MR-287	MR-290	MR-291	MR-292
	DESCRIPTION		GREENPOINT AVENUE STATION	NASSAU AVE	FLUSHING AVE MARCY AVE	CLASSON AVE	CLINTON & WASHINGTON AVES	FULTON ST LAFAYETTE AVE
1	AUTOMATIC PLATFORM GATES (APG'S)		$16,097,725	$16,302,839	$16,193,925	$16,183,453	$16,121,125	$16,302,839
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$16,097,725	$16,302,839	$16,193,925	$16,183,453	$16,121,125	$16,302,839
4	GENERAL REQUIREMENTS	15.00%	$2,414,659	$2,445,426	$2,429,089	$2,427,518	$2,418,169	$2,445,426
	SUB-TOTAL:		$18,512,384	$18,748,265	$18,623,014	$18,610,972	$18,539,294	$18,748,265
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,628,096	$4,687,066	$4,655,753	$4,652,743	$4,634,823	$4,687,066
	SUB-TOTAL:		$23,140,480	$23,435,331	$23,278,767	$23,263,714	$23,174,117	$23,435,331
6	OVERHEAD & PROFIT	15.00%	$3,471,072	$3,515,300	$3,491,815	$3,489,557	$3,476,118	$3,515,300
	SUB-TOTAL:		$26,611,552	$26,950,631	$26,770,582	$26,753,272	$26,650,235	$26,950,631
7	BONDS & INSURANCE	3.75%	$997,933	$1,010,649	$1,003,897	$1,003,248	$999,384	$1,010,649
	SUB-TOTAL:		$27,609,485	$27,961,279	$27,774,479	$27,756,519	$27,649,619	$27,961,279
	SUB-TOTAL:		$27,609,485	$27,961,279	$27,774,479	$27,756,519	$27,649,619	$27,961,279
	SUBTOTAL CONSTRUCTION COST W/O ACM		$27,609,485	$27,961,279	$27,774,479	$27,756,519	$27,649,619	$27,961,279
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		$27,609,485	$27,961,279	$27,774,479	$27,756,519	$27,649,619	$27,961,279
10	DESIGN CONSULTANT FEES	10.00%	$2,760,948	$2,796,128	$2,777,448	$2,775,652	$2,764,962	$2,796,128
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST		$30,370,433	$30,757,407	$30,551,927	$30,532,171	$30,414,580	$30,757,407

	ADD ALTERNATIVES							
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		5,067,616	5,486,685	4,643,920	4,679,314	4,705,360	5,240,496
	Add for Markups (as above)	88.66%	4,493,095	4,864,654	4,117,434	4,148,815	4,171,908	4,646,376
			$9,560,711	$10,351,339	$8,761,354	$8,828,129	$8,877,268	$9,886,872

31-Aug-18

STATION: GREENPOINT AVENUE STATION

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [BROOKLYN BOUND] =	660	LF		
5	LENGTH OF THE PLATFORM EDGE [QUEENS BOUND] =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,320	LF		
7	NUMBER OF TRAIN CARS ON THIS LINE =	8	CARS		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
19	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	264	EA	110	29,040
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800

STATION: GREENPOINT AVENUE STATION

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	384	LF	110	42,240
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	Equipment Room [6'-6" x 16'-0"]				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	29	LF	90	2,610
39	CMU Wall for equipment room	290	SF	45	13,050
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	104	SF	30	3,120
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	290	SF	40	11,600
45	Mosaic Band to match existing - Assuming 8" high	29	LF	120	3,480
46	Concrete cove to match existing	29	LF	20	580
47	Interior Wall Finish - Paint	290	SF	5	1,450
48	Allow for Misc. floor & ceiling finishes	104	SF	15	1,560
49	Allow for 4" thick concrete pads for equipment	26	SF	20	520
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54	Allowance for additional builders work (chases, coring, patching, etc.) associated with locating Equipment Room at Mezzanine Level	1	LS	10,000	10,000
55					
56	Automatic Platform Gates [APGs] - 4'-6" High				
57	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
58	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	10,500	651,000
59	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
60	Platform End Gates (PEGs)	4	EA	13,000	52,000
61	Fixed Panels including framing and support; 4'-6" High	3,303	SF	750	2,477,250
62	Spare Parts - Approx. 10% of Material Cost	1	LS	250,815	250,815
63	Testing and commissioning	800	HRS	160	127,944
64	Product Warranty	1	LS	1,000,000	1,000,000
65	Allowance for Braille Signage	64	EA	2,500	160,000
66					
67	Electrical				
68	Electrical Upgrades				
69	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
70	Power and Lighting				

STATION: GREENPOINT AVENUE STATION

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
72	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200
73	PSD Connections	1	LS	75,000	75,000
74	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
75	Power to PSD Rooms from EDR [Conduit & Cable]	100	LF	60	6,000
76	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
77	Allowance for power to cross tracks to opposite platform	1	LS	15,000	15,000
78	No allowance for new lighting as if APG's are used		Note		EXCL.
79	Grounding				
80	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
81	MISC				
82	Testing and commissioning	1	LS	30,000	30,000
83	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
84					
85	Communications				
86	FA System				
87	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
88	CCTV coverage				
89	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
90	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
91	Berthing Technology Sensors				
92	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
93	Train Door Detection System				
94	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
95	Entrapment concerns				
96	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
97	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
98	Engineering and Testing	2,000	Hrs	160	319,860
99	Centralized monitoring/control				
100	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
101	MISC				
102	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000

31-Aug-18

STATION: GREENPOINT AVENUE STATION

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
103	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
104	Site Survey and Inspections	1	LS	100,000	100,000
105	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
106	Furnish Test Equipment allowance	1	LS	500,000	500,000
107	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
108					
109	Training				
110	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
111					
112	Out of hours Work				
113	Allow loss of production to work at night say 50%	1	LS	3,714,860	3,714,860
115	TOTAL PSD WORK:				$ 16,097,725

117					
118	ADD ALTERNATIVE				
119					
120	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
121					
122	ADD				
123	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
124	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	15,000	930,000
125	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
126	Platform End Gates (PEGs)	4	EA	18,000	72,000
127	Fixed Panels including framing and support; Assuming 8'-0" high	6,654	SF	750	4,990,293
128	Spare Parts - Approx. 10% of Material Cost	1	LS	459,138	459,138
129	Structual framing / bracing				
130	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
131	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
132	Drilling and bolting - 4 bolts at each connection	528	EA	216	114,048
133	Extra Structure frame at locations with different ceiling height; Approx. 100' long	1	LS	300,000	300,000
134	Platform Edge Repair				
135	Remove concrete platform edge	1,320	LF	27	35,640
136	Platform edge repair	1,320	LF	109	143,880
137	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	528	EA	10	5,280
138					
139	OMIT				
140	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	(64)	EA	15,000	(960,000)
141	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	(62)	EA	10,500	(651,000)

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations

31-Aug-18

STATION: GREENPOINT AVENUE STATION

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
143	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
144	Fixed Panels including framing and support; 4'-6" High	(3,303)	SF	750	(2,477,250)
145	Spare Parts - Approx. 10% of Material Cost	(1)	LS	250,815	(250,815)
146	Platform Edge Reconstruction work	(1)	LS	569,960	(569,960)
147	Remove allowance for cast in sleeves for LV & HV power	(264)	EA	110	(29,040)
148	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
149					
150	Allow loss of production to work at night say 50%	1	LS	1,169,450	1,169,450
151					
152	PREMIUM ASSOCIATED WITH PSD's				5,067,616

STATION: NASSAU AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [BROOKLYN BOUND] =	680	LF		
5	LENGTH OF THE PLATFORM EDGE [QUEENS BOUND] =	680	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,360	LF		
7	NUMBER OF TRAIN CARS ON THIS LINE =	8	CARS		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,360	LF	7	9,520
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,800	SF	12	81,600
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	137	CY	2,500	342,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,362	EA	25	34,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,362	EA	25	34,050
19	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
20	Polyethylene edge strip	1,360	LF	95	129,200
21	Provide sleeves for HV & LV wires	264	EA	110	29,040
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,360	LF	15	20,400
26	Remove existing platform tiles	1,360	LF	12	16,320
27	Sawcut existing topping concrete at perimeter of removal area	1,360	LF	5	6,800
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,160	SF	8	65,280
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,360	SF	15	20,400

STATION: NASSAU AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	384	LF	110	42,240
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	Equipment Room [6'-6" x 16'-0"]				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	29	LF	90	2,610
39	CMU Wall for equipment room	290	SF	45	13,050
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	104	SF	30	3,120
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	290	SF	40	11,600
45	Mosaic Band to match existing - Assuming 8" high	29	LF	120	3,480
46	Concrete cove to match existing	29	LF	20	580
47	Interior Wall Finish - Paint	290	SF	5	1,450
48	Allow for Misc. floor & ceiling finishes	104	SF	15	1,560
49	Allow for 4" thick concrete pads for equipment	26	SF	20	520
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	Automatic Platform Gates [APGs] - 4'-6" High				
56	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	10,500	651,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	3,483	SF	750	2,612,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	258,915	258,915
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	64	EA	2,500	160,000
65					
66	Electrical				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

STATION: NASSAU AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,360	LF	60	81,600
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	Allowance for power to cross tracks to opposite platform	1	LS	15,000	15,000
77	No allowance for new lighting as if APG's are used		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
80	MISC				
81	Testing and commissioning	1	LS	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
83					
84	Communications				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
97	Engineering and Testing	2,000	Hrs	160	319,860
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations

31-Aug-18

STATION: NASSAU AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	3,762,194	3,762,194
113					
114	TOTAL PSD WORK:				$ 16,302,839

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Relocate existing platform edge light fittings and lighting supports including modifying / extending existing circuits	1,360	LF	375	510,000
123	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
124	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	15,000	930,000
125	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
126	Platform End Gates (PEGs)	4	EA	18,000	72,000
127	Fixed Panels including framing and support; Assuming 8'-0" high	6,974	SF	750	5,230,293
128	Spare Parts - Approx. 10% of Material Cost	1	LS	473,538	473,538
129	Structual framing / bracing				
130	HSS4x4x1/2 hanger	5	TONS	17,500	90,150
131	L6x6x1/2 continuous angle	10	TONS	17,500	175,168
132	Drilling and bolting - 4 bolts at each connection	544	EA	216	117,504
133	Platform Edge Repair				
134	Remove concrete platform edge	1,360	LF	27	36,720
135	Platform edge repair	1,360	LF	109	148,240
136	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	528	EA	10	5,280
137					
138	OMIT				
139	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	(64)	EA	15,000	(960,000)
140	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	(62)	EA	10,500	(651,000)
141	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations

31-Aug-18

STATION: NASSAU AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
143	Fixed Panels including framing and support; 4'-6" High	(3,483)	SF	750	(2,612,250)
144	Spare Parts - Approx. 10% of Material Cost	(1)	LS	258,915	(258,915)
145	Platform Edge Reconstruction work	(1)	LS	584,360	(584,360)
146	Remove allowance for cast in sleeves for LV & HV power	(264)	EA	110	(29,040)
147	Conduit running under Platform Edge	(1,360)	LF	30	(40,800)
149	Allow loss of production to work at night say 50%	1	LS	1,266,158	1,266,158
150					
151					
152	PREMIUM ASSOCIATED WITH PSD's				5,486,685

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations

31-Aug-18

STATION: FLUSHING AVE MARCY AV

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [BROOKLYN BOUND] =	660	LF		
5	LENGTH OF THE PLATFORM EDGE [QUEENS BOUND] =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,320	LF		
7	NUMBER OF TRAIN CARS ON THIS LINE =	8	CARS		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
19	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	264	EA	110	29,040
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800

STATION: FLUSHING AVE MARCY AV

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	384	LF	110	42,240
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	Equipment Room [6'-6" x 16'-0"]				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	29	LF	90	2,610
39	CMU Wall for equipment room	290	SF	45	13,050
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	104	SF	30	3,120
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	290	SF	40	11,600
45	Mosaic Band to match existing - Assuming 8" high	29	LF	120	3,480
46	Concrete cove to match existing	29	LF	20	580
47	Interior Wall Finish - Paint	290	SF	5	1,450
48	Allow for Misc. floor & ceiling finishes	104	SF	15	1,560
49	Allow for 4" thick concrete pads for equipment	26	SF	20	520
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	Automatic Platform Gates [APGs] - 4'-6" High				
56	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	10,500	651,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	3,303	SF	750	2,477,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	250,815	250,815
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	64	EA	2,500	160,000
65					
66	Electrical				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

STATION: FLUSHING AVE MARCY AV

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	800	LF	60	48,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	850	LF	60	51,000
76	Allowance for power to cross tracks to opposite platform	1	LS	15,000	15,000
77	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
80	MISC				
81	Testing and commissioning	1	LS	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
83					
84	Communications				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
97	Engineering and Testing	2,000	Hrs	160	319,860
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations

31-Aug-18

STATION: FLUSHING AVE MARCY AV

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	3,737,060	3,737,060
114	TOTAL PSD WORK:				$ 16,193,925

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	15,000	930,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	6,654	SF	750	4,990,293
127	Spare Parts - Approx. 10% of Material Cost	1	LS	459,138	459,138
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
130	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Platform Edge Repair				
133	Remove concrete platform edge	1,320	LF	27	35,640
134	Platform edge repair	1,320	LF	109	143,880
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	528	EA	10	5,280
136					
137	OMIT				
138	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	(64)	EA	15,000	(960,000)
139	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	(62)	EA	10,500	(651,000)
140	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
141	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations

31-Aug-18

STATION: FLUSHING AVE MARCY AV

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
142	Fixed Panels including framing and support; 4'-6" High	(3,303)	SF	750	(2,477,250)
143	Spare Parts - Approx. 10% of Material Cost	(1)	LS	250,815	(250,815)
144	Platform Edge Reconstruction work	(1)	LS	569,960	(569,960)
145	Remove allowance for cast in sleeves for LV & HV power	(264)	EA	110	(29,040)
146	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
147					
148	Allow loss of production to work at night say 50%	1	LS	1,071,674	1,071,674
149					
150	PREMIUM ASSOCIATED WITH PSD's				4,643,920

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations

31-Aug-18

STATION: CLASSON AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [BROOKLYN BOUND] =	665	LF		
5	LENGTH OF THE PLATFORM EDGE [QUEENS BOUND] =	665	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,330	LF		
7	NUMBER OF TRAIN CARS ON THIS LINE =	8	CARS		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,330	LF	7	9,310
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,650	SF	12	79,800
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	134	CY	2,500	335,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,332	EA	25	33,300
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,332	EA	25	33,300
19	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
20	Polyethylene edge strip	1,330	LF	95	126,350
21	Provide sleeves for HV & LV wires	264	EA	110	29,040
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,330	LF	15	19,950
26	Remove existing platform tiles	1,330	LF	12	15,960
27	Sawcut existing topping concrete at perimeter of removal area	1,330	LF	5	6,650
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,980	SF	8	63,840
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,330	SF	15	19,950

STATION: CLASSON AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	384	LF	110	42,240
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	Equipment Room [6'-6" x 16'-0"]				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	29	LF	90	2,610
39	CMU Wall for equipment room	290	SF	45	13,050
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	104	SF	30	3,120
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	290	SF	40	11,600
45	Mosaic Band to match existing - Assuming 8" high	29	LF	120	3,480
46	Concrete cove to match existing	29	LF	20	580
47	Interior Wall Finish - Paint	290	SF	5	1,450
48	Allow for Misc. floor & ceiling finishes	104	SF	15	1,560
49	Allow for 4" thick concrete pads for equipment	26	SF	20	520
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54	Allowance for additional builders work (chases, coring, patching, etc.) associated with locating Equipment Room at Mezzanine Level	1	LS	10,000	10,000
55					
56	Automatic Platform Gates [APGs] - 4'-6" High				
57	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
58	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	10,500	651,000
59	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
60	Platform End Gates (PEGs)	4	EA	13,000	52,000
61	Fixed Panels including framing and support; 4'-6" High	3,348	SF	750	2,511,000
62	Spare Parts - Approx. 10% of Material Cost	1	LS	252,840	252,840
63	Testing and commissioning	800	HRS	160	127,944
64	Product Warranty	1	LS	1,000,000	1,000,000
65	Allowance for Braille Signage	64	EA	2,500	160,000
66					
67	Electrical				
68	Electrical Upgrades				
69	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.

STATION: CLASSON AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
70	Power and Lighting				
71	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
72	Allow for conduit / cable runs for power and communications under platform edge	1,330	LF	60	79,800
	PSD Connections	1	LS	75,000	75,000
74	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
75	Power to PSD Rooms from EDR [Conduit & Cable]	300	LF	60	18,000
76	Reserve power to PSD Room from EDR [Conduit & Cable]	350	LF	60	21,000
77	Allowance for power to cross tracks to opposite platform	1	LS	15,000	15,000
78	No allowance for new lighting as if APG's are used		Note		EXCL.
79	Grounding				
80	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
81	MISC				
82	Testing and commissioning	1	LS	30,000	30,000
83	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
84					
85	**Communications**				
86	FA System				
87	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
88	CCTV coverage				
89	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
90	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
91	Berthing Technology Sensors				
92	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
93	Train Door Detection System				
94	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
95	Entrapment concerns				
96	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
97	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
98	Engineering and Testing	2,000	Hrs	160	319,860
99	Centralized monitoring/control				
100	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
101	MISC				

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations

31-Aug-18

STATION: CLASSON AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
103	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
104	Site Survey and Inspections	1	LS	100,000	100,000
105	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
106	Furnish Test Equipment allowance	1	LS	500,000	500,000
107	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
108					
109	Training				
110	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
111					
112	Out of hours Work				
113	Allow loss of production to work at night say 50%	1	LS	3,734,643	3,734,643
115	TOTAL PSD WORK:				$ 16,183,453

117					
118	ADD ALTERNATIVE				
119					
120	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
121					
122	ADD				
123	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
124	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	15,000	930,000
125	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
126	Platform End Gates (PEGs)	4	EA	18,000	72,000
127	Fixed Panels including framing and support; Assuming 8'-0" high	6,734	SF	750	5,050,293
128	Spare Parts - Approx. 10% of Material Cost	1	LS	462,738	462,738
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,332	EA	25	33,300
19	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
20	Polyethylene edge strip	1,330	LF	95	126,350
21	Provide sleeves for HV & LV wires	264	EA	110	29,040
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,330	LF	15	19,950
26	Remove existing platform tiles	1,330	LF	12	15,960
27	Sawcut existing topping concrete at perimeter of removal area	1,330	LF	5	6,650
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,980	SF	8	63,840
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations

31-Aug-18

STATION: CLASSON AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
143	Fixed Panels including framing and support; 4'-6" High	(3,348)	SF	750	(2,511,000)
144	Spare Parts - Approx. 10% of Material Cost	(1)	LS	252,840	(252,840)
145	Platform Edge Reconstruction work	(1)	LS	573,560	(573,560)
146	Remove allowance for cast in sleeves for LV & HV power	(264)	EA	110	(29,040)
147	Conduit running under Platform Edge	(1,330)	LF	30	(39,900)
148					
149	Allow loss of production to work at night say 50%	1	LS	1,079,842	1,079,842
150					
151	PREMIUM ASSOCIATED WITH PSD's				4,679,314

STATION: CLINTON & WASHINGTON AVES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [BROOKLYN BOUND] =	660	LF		
5	LENGTH OF THE PLATFORM EDGE [QUEENS BOUND] =	660	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,320	LF		
7	NUMBER OF TRAIN CARS ON THIS LINE =	8	CARS		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,320	LF	7	9,240
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,600	SF	12	79,200
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	133	CY	2,500	332,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,322	EA	25	33,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,322	EA	25	33,050
19	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
20	Polyethylene edge strip	1,320	LF	95	125,400
21	Provide sleeves for HV & LV wires	264	EA	110	29,040
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,320	LF	15	19,800
26	Remove existing platform tiles	1,320	LF	12	15,840
27	Sawcut existing topping concrete at perimeter of removal area	1,320	LF	5	6,600
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,920	SF	8	63,360
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,320	SF	15	19,800

STATION: CLINTON & WASHINGTON AVES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	384	LF	110	42,240
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	Equipment Room [6'-6" x 16'-0"]				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	29	LF	90	2,610
39	CMU Wall for equipment room	290	SF	45	13,050
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	104	SF	30	3,120
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	290	SF	40	11,600
45	Mosaic Band to match existing - Assuming 8" high	29	LF	120	3,480
46	Concrete cove to match existing	29	LF	20	580
47	Interior Wall Finish - Paint	290	SF	5	1,450
48	Allow for Misc. floor & ceiling finishes	104	SF	15	1,560
49	Allow for 4" thick concrete pads for equipment	26	SF	20	520
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54	Allowance for additional builders work (chases, coring, patching, etc.) associated with locating Equipment Room at Mezzanine Level	1	LS	10,000	10,000
55					
56	Automatic Platform Gates [APGs] - 4'-6" High				
57	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
58	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	10,500	651,000
59	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
60	Platform End Gates (PEGs)	4	EA	13,000	52,000
61	Fixed Panels including framing and support; 4'-6" High	3,303	SF	750	2,477,250
62	Spare Parts - Approx. 10% of Material Cost	1	LS	250,815	250,815
63	Testing and commissioning	800	HRS	160	127,944
64	Product Warranty	1	LS	1,000,000	1,000,000
65	Allowance for Braille Signage	64	EA	2,500	160,000
66					
67	Electrical				
68	Electrical Upgrades				
69	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
70	Power and Lighting				

STATION: CLINTON & WASHINGTON AVES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
72	Allow for conduit / cable runs for power and communications under platform edge	1,320	LF	60	79,200
	PSD Connections	1	LS	75,000	75,000
74	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
75	Power to PSD Rooms from EDR [Conduit & Cable]	250	LF	60	15,000
76	Reserve power to PSD Room from EDR [Conduit & Cable]	300	LF	60	18,000
77	Allowance for power to cross tracks to opposite platform	1	LS	15,000	15,000
78	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
79	Grounding				
80	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
81	MISC				
82	Testing and commissioning	1	LS	30,000	30,000
83	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
84					
85	Communications				
86	FA System				
87	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
88	CCTV coverage				
89	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
90	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
91	Berthing Technology Sensors				
92	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
93	Train Door Detection System				
94	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
95	Entrapment concerns				
96	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
97	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
98	Engineering and Testing	2,000	Hrs	160	319,860
99	Centralized monitoring/control				
100	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations

31-Aug-18

STATION: CLINTON & WASHINGTON AVES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
101	MISC				
102	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
103	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
104	Site Survey and Inspections	1	LS	100,000	100,000
105	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
106	Furnish Test Equipment allowance	1	LS	500,000	500,000
107	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
108					
109	Training				
110	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
111					
112	Out of hours Work				
113	Allow loss of production to work at night say 50%	1	LS	3,720,260	3,720,260
115	TOTAL PSD WORK:				$ 16,121,125

117					
118	ADD ALTERNATIVE				
119					
120	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
121					
122	ADD				
123	Relocate Signal Boxes	6	EA	10,240	61,440
124	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
125	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	15,000	930,000
126	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
127	Platform End Gates (PEGs)	4	EA	18,000	72,000
128	Fixed Panels including framing and support; Assuming 8'-0" high	6,654	SF	750	4,990,293
129	Spare Parts - Approx. 10% of Material Cost	1	LS	459,138	459,138
130	Structual framing / bracing				
131	HSS4x4x1/2 hanger	5	TONS	17,500	87,537
132	L6x6x1/2 continuous angle	10	TONS	17,500	170,016
133	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
134	Platform Edge Repair				
135	Remove concrete platform edge	1,320	LF	27	35,640
136	Platform edge repair	1,320	LF	109	143,880
137	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	528	EA	10	5,280
138					
139	OMIT				
140	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	(64)	EA	15,000	(960,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations

31-Aug-18

STATION: CLINTON & WASHINGTON AVES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
141	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	(62)	EA	10,500	(651,000)
142	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
143	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
144	Fixed Panels including framing and support; 4'-6" High	(3,303)	SF	750	(2,477,250)
145	Spare Parts - Approx. 10% of Material Cost	(1)	LS	250,815	(250,815)
146	Platform Edge Reconstruction work	(1)	LS	569,960	(569,960)
147	Remove allowance for cast in sleeves for LV & HV power	(264)	EA	110	(29,040)
148	Conduit running under Platform Edge	(1,320)	LF	30	(39,600)
149					
150	Allow loss of production to work at night say 50%	1	LS	1,071,674	1,071,674
151					
152	PREMIUM ASSOCIATED WITH PSD's				4,705,360

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations

31-Aug-18

STATION: FULTON ST LAFAYETTE AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [BROOKLYN BOUND] =	680	LF		
5	LENGTH OF THE PLATFORM EDGE [QUEENS BOUND] =	680	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,360	LF		
7	NUMBER OF TRAIN CARS ON THIS LINE =	8	CARS		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,360	LF	7	9,520
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,800	SF	12	81,600
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	137	CY	2,500	342,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,362	EA	25	34,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,362	EA	25	34,050
19	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
20	Polyethylene edge strip	1,360	LF	95	129,200
21	Provide sleeves for HV & LV wires	264	EA	110	29,040
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,360	LF	15	20,400
26	Remove existing platform tiles	1,360	LF	12	16,320
27	Sawcut existing topping concrete at perimeter of removal area	1,360	LF	5	6,800
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,160	SF	8	65,280
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,360	SF	15	20,400

STATION: FULTON ST LAFAYETTE AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	384	LF	110	42,240
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	Equipment Room [6'-6" x 16'-0"]				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	29	LF	90	2,610
39	CMU Wall for equipment room	290	SF	45	13,050
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	104	SF	30	3,120
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	290	SF	40	11,600
45	Mosaic Band to match existing - Assuming 8" high	29	LF	120	3,480
46	Concrete cove to match existing	29	LF	20	580
47	Interior Wall Finish - Paint	290	SF	5	1,450
48	Allow for Misc. floor & ceiling finishes	104	SF	15	1,560
49	Allow for 4" thick concrete pads for equipment	26	SF	20	520
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	Automatic Platform Gates [APGs] - 4'-6" High				
56	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	10,500	651,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	3,483	SF	750	2,612,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	258,915	258,915
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	64	EA	2,500	160,000
65					
66	Electrical				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations

31-Aug-18

STATION: FULTON ST LAFAYETTE AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,360	LF	60	81,600
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	Allowance for power to cross tracks to opposite platform	1	LS	15,000	15,000
77	No allowance for new lighting as if APG's are used		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
80	MISC				
81	Testing and commissioning	1	LS	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
83					
84	Communications				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
97	Engineering and Testing	2,000	Hrs	160	319,860
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations

31-Aug-18

STATION: FULTON ST LAFAYETTE AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	3,762,194	3,762,194
114	TOTAL PSD WORK:				$ 16,302,839

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	15,000	930,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	6,974	SF	750	5,230,293
127	Spare Parts - Approx. 10% of Material Cost	1	LS	473,538	473,538
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	90,150
130	L6x6x1/2 continuous angle	10	TONS	17,500	175,168
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Extra for Overhead Structure at locations not covered by station canopy; Approx. 150' long	1	LS	350,000	350,000
133	Platform Edge Repair				
134	Remove concrete platform edge	1,360	LF	27	36,720
135	Platform edge repair	1,360	LF	109	148,240
136	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	528	EA	10	5,280
137					
138	OMIT				
139	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	(64)	EA	15,000	(960,000)
140	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	(62)	EA	10,500	(651,000)
141	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for G Line Stations

31-Aug-18

STATION: FULTON ST LAFAYETTE AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
143	Fixed Panels including framing and support; 4'-6" High	(3,483)	SF	750	(2,612,250)
144	Spare Parts - Approx. 10% of Material Cost	(1)	LS	258,915	(258,915)
145	Platform Edge Reconstruction work	(1)	LS	584,360	(584,360)
146	Remove allowance for cast in sleeves for LV & HV power	(264)	EA	110	(29,040)
147	Conduit running under Platform Edge	(1,360)	LF	30	(40,800)
148					
149	Allow loss of production to work at night say 50%	1	LS	1,209,345	1,209,345
150					
151					
152	PREMIUM ASSOCIATED WITH PSD's				5,240,496

Appendix F

Meeting Minutes

Operations Planning Meeting

Issued: 8/09/18

C–32516: Platform Screen Door (PSD) System-Wide Feasibility Study

MEETING PURPOSE: Vehicle Assignments on G-Service – Impact to PSD Feasibility Study

MEETING DATE: August 9, 2018

ATTENDEES:

Don Willemann	NYCT – CPM Systems & Security
Glenn Lunden	NYCT – Operations Planning
David Foell	STV
Liz Opper	STV
Khaled Mohamed	STV

Meeting Minutes

Issue / Action Description

VEHICLE ASSIGNMENTS TO G-LINE:

The purpose of the meeting was to establish an assumed future vehicle assignment for G-train service encompassing the PSD feasibility study design year of 2032.

1) Glenn Lunden made the following observations in regard to this subject:

   a. Current G-trains are 300' long each (four 75-foot cars).

   b. As part of the L-train (Canarsie Line) shutdown mitigation in 2019, the trains are to be lengthened to eight 60-foot cars.

   c. Current expectations are for the eight 60-foot car assignments to remain permanently after the Canarsie Line is restored to service; this has not been confirmed by senior NYCT management, but should be assumed for the purposes of this analysis.

   d. F-train service is occasionally diverted to the G-train line when there are significant traffic issues in Manhattan. The F-trains utilize 10-car trains, comprised of 60-foot cars.

   e. There are no plans to lengthen G-trains to use a 10-car train.

2) It was noted that 10-car trains and 8-car trains cannot share a PSD system due to dimensional differences in the door placement in the A-car and B-car of the respective train consists. Therefore, any PSD system oriented toward the G-train 8-car train would preclude the possibility of an F-train stopping at any of the G-train service stations.

3) **Conclusion:** it was decided to study PSD installation assuming usage by only the 8-car G-train. The feasibility report will note that future diversions of F-train service will be precluded or limited to thru-service without any stops between Queens Plaza, Queens, and Hoyt Schermerhorn in downtown Brooklyn (a 12-station bypass).

MTA New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR 'JZ' LINE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

FINAL SUBMITTAL DATE: October 17, 2018

STV 100 Years

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Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 30 newly evaluated stations, 24 have been found to be not suitable for the installation of PSDs.

[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to low-height barriers]

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues; the platform edge barriers are 15" wide. Where an existing object (wall, stair, and railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Where these PSDs hamper the ability of a wheelchair to turn (a 5'-0" circle) and/or limit path of travel to less than 32" pinch width, it is declared infeasible. This requirement dictates that if a column or any obstruction measuring less than or equal to 24" in the direction of circulation is present, it may not constrain the circulation path to less than 32".
- Insufficient space for the PSD equipment room; the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow; due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements in regard to the placement of these new barriers in an existing station environment.
- Structural considerations; existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the previously proposed 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the PSD barriers and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is used for refuse removal at Sutphin Blvd and Jamaica Center/ Parsons. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the (off) loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in damage from these carts along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process

The table on the following page summarizes these findings, and shows that platform edge barriers are feasible at 20% of the 'JZ' Line stations. Total implementation cost would be $170.0M for APGs and $213.8M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; That estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of $931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 6 feasible stations, the aggregate annual maintenance cost would be $5.6M.

Summary Table

J, Z Line Summary of Feasibility				(20% feasible; 6/30)			
MR No.	Station Name	Station Type	Platform Type	Feasible Yes / No	Issues / Reason for Failure	Cost APGs	Cost PSDs
80	121st Street	ELV	Side	No	ADA Clearance	-	-
81	111th Street	ELV	Side	No	ADA Clearance	-	-
82	104th Street	ELV	Side	No	ADA Clearance	-	-
83	Woodhaven Blvd.	ELV	Side	No	ADA Clearance	-	-
84	85th St. Forest Parkway	ELV	Side	No	ADA Clearance	-	-
85	75th St. Elderts Lane	ELV	Side	No	ADA Clearance	-	-
86	Cypress Hills	ELV	Side	No	ADA Clearance	-	-
87	Crescent Street	ELV	Center/Island	No	Precast	-	-
88	Norwood Avenue	ELV	Center/Island	No	Precast	-	-
89	Cleveland Street	ELV	Center/Island	No	Precast	-	-
90	Van Siclen Avenue	ELV	Center/Island	No	Precast	-	-
91	Alabama Avenue	ELV	Center/Island	No	Precast	-	-
92	Broadway Junction	ELV	Center/island	No	ADA Clearance	-	-
93	Chauncey Street	ELV	Side	No	ADA Clearance	-	-
94	Halsey Street	ELV	Side	No	ADA Clearance	-	-
95	Gates Avenue	ELV	Side	No	ADA Clearance	-	-
96	Kosciuszko Street	ELV	Side	No	ADA Clearance	-	-
97	Myrtle Avenue - Broadway	ELV	Side	No	ADA Clearance	-	-
98	Flushing Avenue	ELV	Side	No	ADA Clearance	-	-
99	Lorimer Street	ELV	Side	No	ADA Clearance	-	-
100	Hewes Street	ELV	Side	No	ADA Clearance	-	-
101	Marcy Avenue	ELV	Side	No	Precast	-	-
102	Delancey Street Essex St.	SUB	Center/Island	No	ADA Clearance	-	-
103	Bowery	SUB	Center/island	Yes	-	$28.6M	$35.6M
104	Canal Street	SUB	Center/island	Yes	-	$26.3M	$32.5M
105	Chambers Street	SUB	Center/island	No	ADA Clearance	-	-
106	Fulton Street	SUB	Side	Yes	-	$27.4M	$34.1M
107	Broad Street	SUB	Side	Yes	-	$27.4M	$34.1M
278	Jamaica Center/ Parsons	SUB	Center/Island	Yes	-	$30.2M	$38.8M
279	Sutphin Boulevard	SUB	Center/Island	Yes	-	$30.1M	$38.8M
					TOTAL	**$170.0M**	**$213.8M**

1.0 Station Assessments

1.01 – MRN 080 | 121st Street Station

Summary: *121st Street Station is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.*

Description

121st Street Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 7'-10" throughout. There are two staircases at each end of the platforms. Currently the stair guardrail sits 28" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 13" would not allow for ADA compliant wheelchair movement nor normal passenger movement. See figure 1 for reference.

Figure 1 *– Non-Compliant ADA condition*
121st Street Station

1.02 – MRN 081 | 111st Street Station

Summary: *111st Street Station is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.*

Description

111st Street Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 7'-10" throughout. There are two staircases at each end of the platforms. Currently the stair guardrail sits 24" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 9" would not allow for ADA compliant wheelchair movement nor normal passenger movement. See figure 1 for reference.

Figure 1 *– Non-Compliant ADA condition*
111st Street Station

1.03 – MRN 082 | 104th Street Station

Summary: *104th Street Station is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.*

Description

104th Street Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 8'-0" throughout. There are two staircases at each end of the platforms. Currently the stair guardrail sits 24" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 9" would not allow for ADA compliant wheelchair movement nor normal passenger movement. See figure 1 for reference.

***Figure 1** – Non-Compliant ADA condition*
104th Street Station

1.04 – MRN 083 | Woodhaven Boulevard Station

Summary: *Woodhaven Boulevard Station is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.*

Description

Woodhaven Boulevard Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 7'-10" throughout. There are two staircases at each end of the platforms. Currently the stair guardrail sits 20" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 5" would not allow for ADA compliant wheelchair movement nor normal passenger movement. See figure 1 for reference.

Figure 1 *– Non-Compliant ADA condition*
Woodhaven Boulevard Station

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1.05 – MRN 084 | 85th Street-Forest Parkway Station

Summary: *85th Street-Forest Parkway Station is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.*

Description

85th Street-Forest Parkway Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 7'-10" throughout. There are two staircases at each end of the platforms. Currently the stair guardrail sits 20" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 5" would not allow for ADA compliant wheelchair movement nor normal passenger movement. See figure 1 for reference.

***Figure 1** – Non-Compliant ADA condition*
85th Street-Forest Parkway Station

1.06 – MRN 085 | 75th Street-Elders Lane Station

Summary: *75th Street-Elders Lane Station is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.*

Description

75th Street-Elders Lane Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 7'-8" throughout. There are two staircases at each end of the platforms. Currently the stair guardrail sits 24" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 5" would not allow for ADA compliant wheelchair movement nor normal passenger movement. See figure 1 for reference.

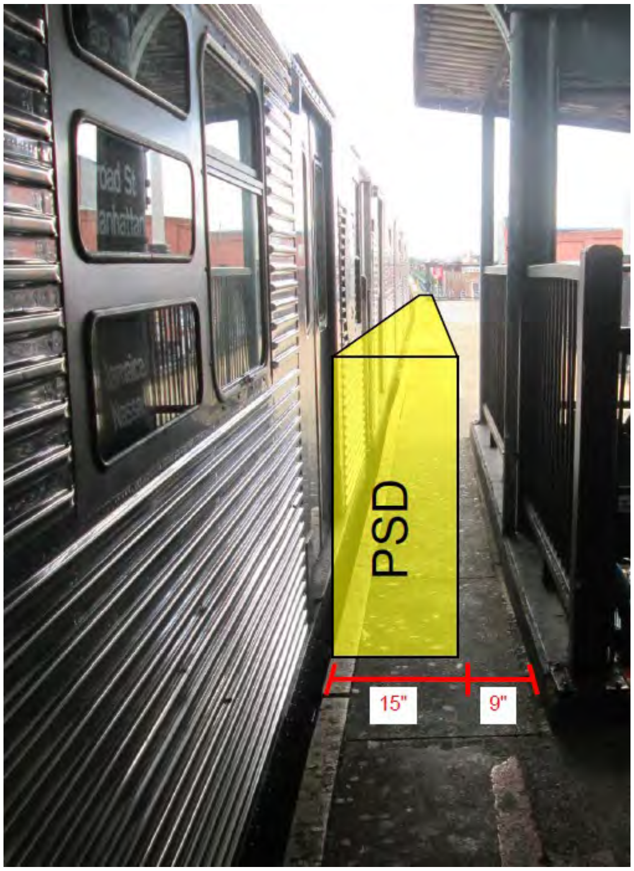

Figure 1 *– Non-Compliant ADA condition*
75th Street-Elders Lane Station

1.07 – MRN 086 | Cypress Hills Station

Summary: *Cypress Hills Station is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.*

Description

Cypress Hills Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 7'-8" throughout. There are two staircases at each end of the platforms. Currently the stair guardrail sits 22" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 7" would not allow for ADA compliant wheelchair movement nor normal passenger movement. See figure 1 for reference.

***Figure 1** – Non-Compliant ADA condition*
Cypress Hills Station

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1.08 – MRN 087 | Crescent Street Station

Summary: *Crescent Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 1).*

Description

Crescent Street Station is an elevated station consisting one center/island platform. The platform is approximately 17'-0" wide. The platform is straight with a row of a columns in the center of the platform, which support the station canopy. The canopy covers approximately a third of the platform length. See figure 1 for reference.

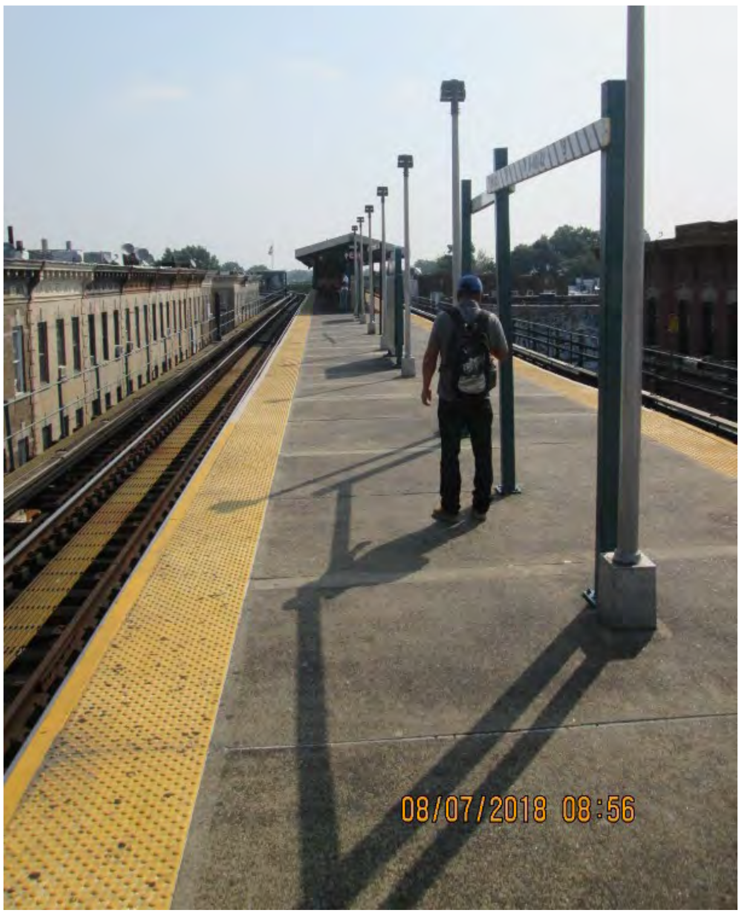

Figure 1 *– Precast platform*
Crescent Street Station

1.09 – MRN 088 | Norwood Avenue Station

Summary: *Norwood Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 1).*

Description

Norwood Avenue Station is an elevated station consisting one center/island platform. The platform width varies from approximately 12'-6" to17'-0" wide. The platform is straight with a row of a columns in the center of the platform, which support the station canopy. The canopy covers a quarter of the platform length. See figure 1 for reference.

Figure 1 *– Precast platform*
Norwood Avenue Station

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1.10 – MRN 089 | Cleveland Street Station

Summary: *Cleveland Street Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 1).*

Description

Cleveland Street Station is an elevated station consisting one center/island platform. The platform width is approximately 13-0" wide. The platform is straight with a row of a columns in the center of the platform, which support the station canopy. The canopy covers a quarter of the platform length. See figure 1 for reference.

***Figure 1** – Precast platform*
Cleveland Street Station

1.11 – MRN 090 | Van Siclen Avenue Station

Summary: *Van Siclen Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 1).*

Description

Van Siclen Avenue Station is an elevated station consisting one center/island platform. The platform width is approximately 14-6" wide. The platform is straight with a row of a columns in the center of the platform, which support the station canopy. The canopy covers a quarter of the platform length. See figure 1 for reference.

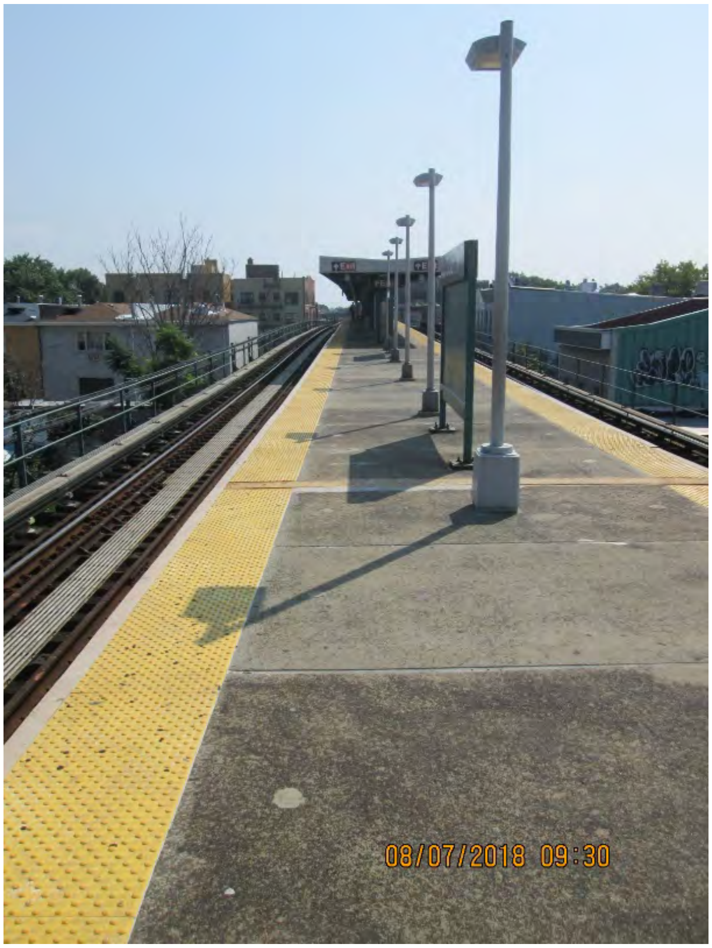

Figure 1 *– Precast platform*
Van Siclen Avenue Station

1.12 – MRN 091 | Alabama Avenue Station

Summary: *Alabama Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 1).*

Description

Alabama Avenue Station is an elevated station consisting one center/island platform. The platform width is approximately 14-6" wide. The platform is straight with a row of a columns in the center of the platform, which support the station canopy. The canopy covers a quarter of the platform length. See figure 1 for reference.

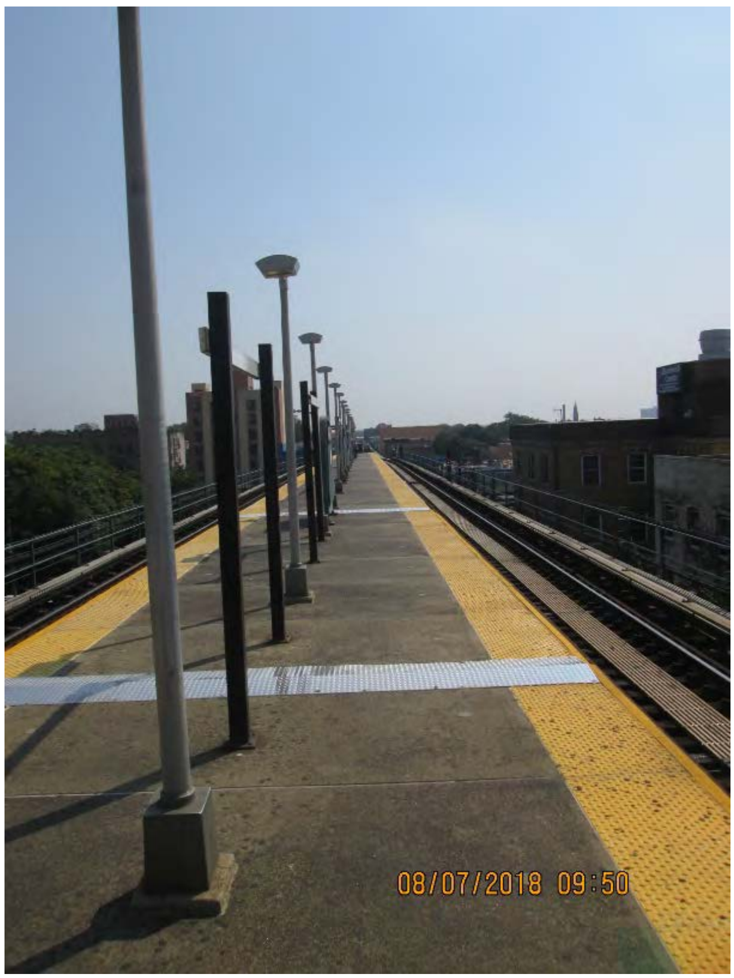

Figure 1 *– Precast platform*
Alabama Avenue Station

1.13 – MRN 092 | Broadway Junction Station

Summary: *Broadway Junction Station is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.*

Description

Broadway Junction Station is an elevated station with two straight center/island platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 14'-0" throughout. There are three staircases throughout each of the platforms. Columns are spaced 15'-0" on center and flank the staircases on both sides. Columns measure 3'-6" away from all platform edges. Currently the stair guardrail sits 40" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 25" would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

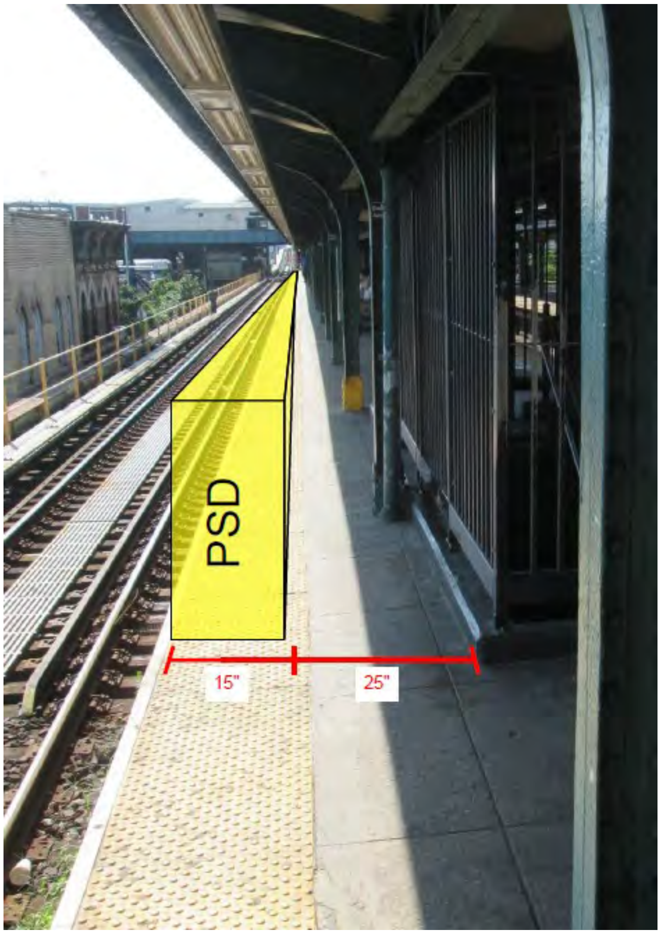

Figure 1 *– Non-Compliant ADA condition*
Broadway Junction Station

1.14 – MRN 093 | Chauncey Street

Summary: *Chauncey Street is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.*

Description

Chauncey Street is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 9'-6" throughout. There are two staircases at each end of the platforms. Currently the stair guardrail sits 40" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 25" would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

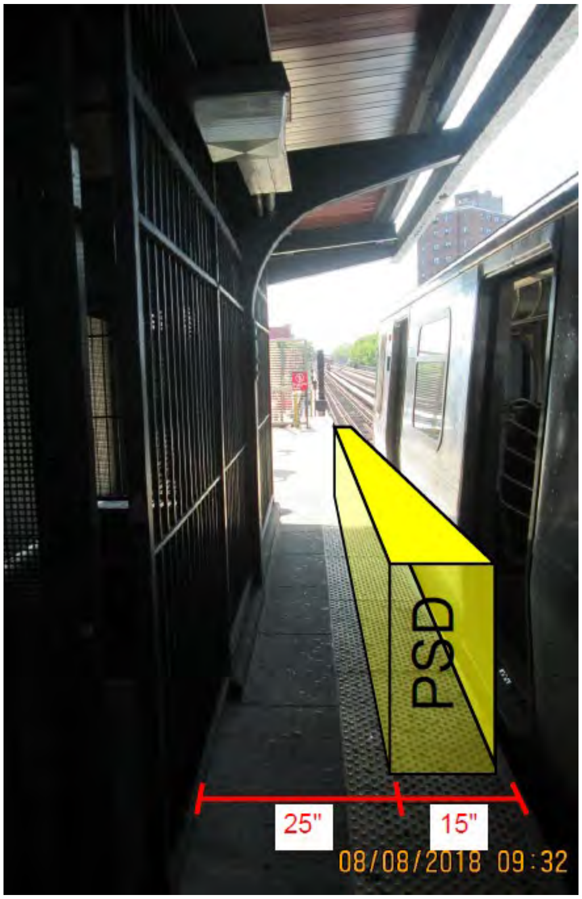

***Figure 1** – Non-Compliant ADA condition*
Chauncey Street

1.15 – MRN 094 | Halsey Street Station

Summary: *Halsey Street is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.*

Description

Halsey Street is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 9'-6" throughout. There are two staircases at each end of the platforms. Currently the stair guardrail sits 40" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 25" would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

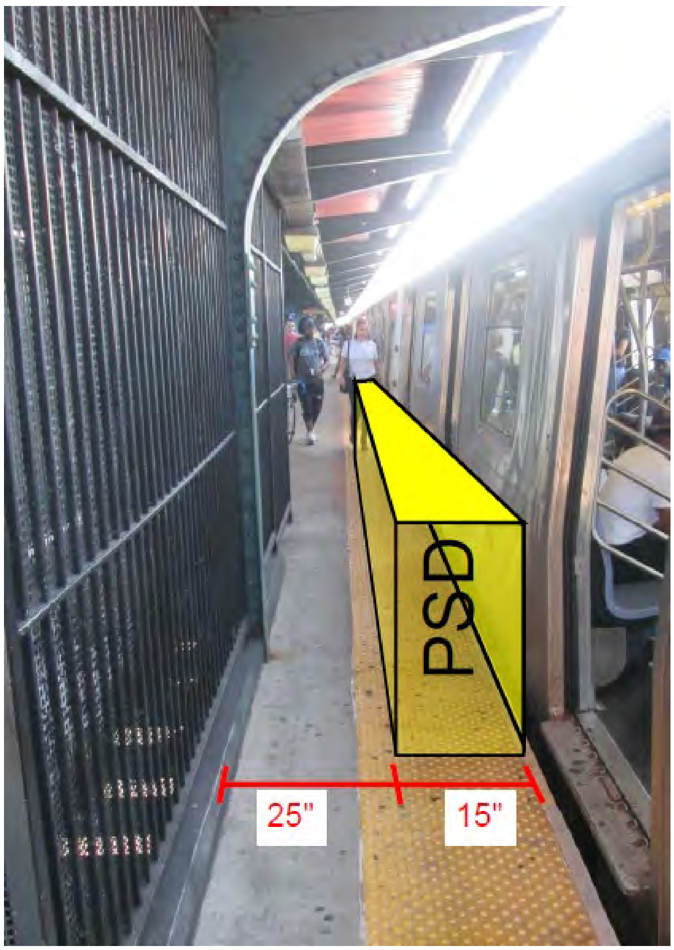

Figure 1 *– Non-Compliant ADA condition*
Halsey Street

1.16 – MRN 095 | Gates Avenue Station

Summary: *Gates Avenue is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.*

Description

Gates Avenue is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 9'-6" throughout. There are two staircases at each end of the platforms. Currently the stair guardrail sits 40" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 25" would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

Figure 1 *– Non-Compliant ADA condition*
Gates Avenue

1.17 – MRN 096 | Kosciusko Street Station

Summary: *Kosciusko Street is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.*

Description

Kosciusko Street is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 9'-6" throughout. There are two staircases at each end of the platforms. Currently the stair guardrail sits 40" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 25" would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

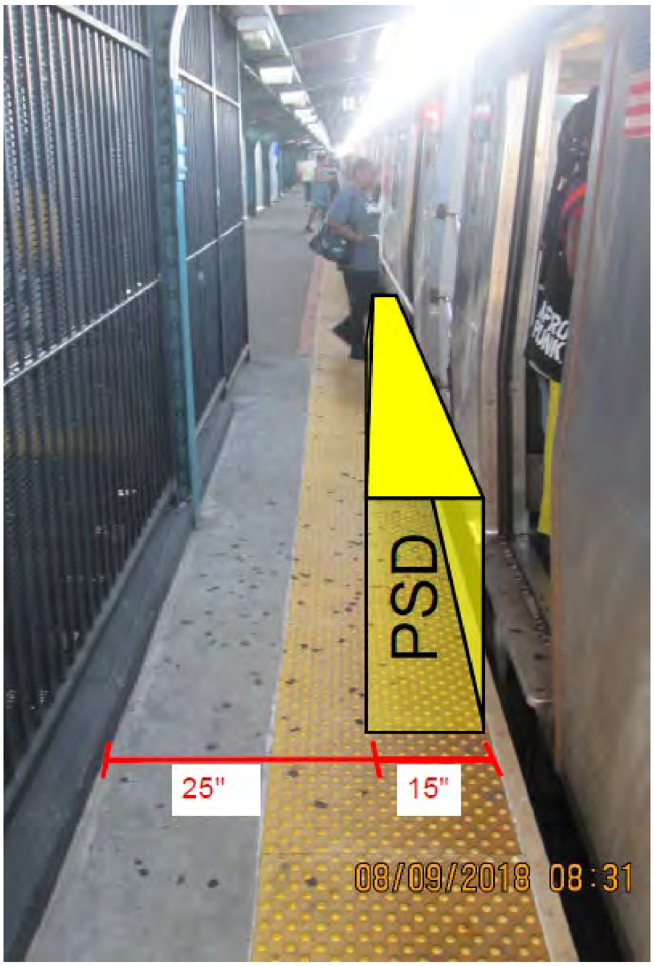

***Figure 1** – Non-Compliant ADA condition*
Kosciusko Street

1.18 – MRN 097 | Myrtle Avenue-Broadway Station

__Summary:__ Myrtle Avenue-Broadway Station is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.

Description

Myrtle Avenue-Broadway Station is an elevated station with two straight center/island platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 14'-0" throughout. There are three staircases throughout each of the platforms. Columns are spaced 15'-4" on center and flank the staircases on both sides. Columns measure between 3'-10" and 2'-10" away from all platform edges. Currently the stair guardrail and columns sit 46" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 31" would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

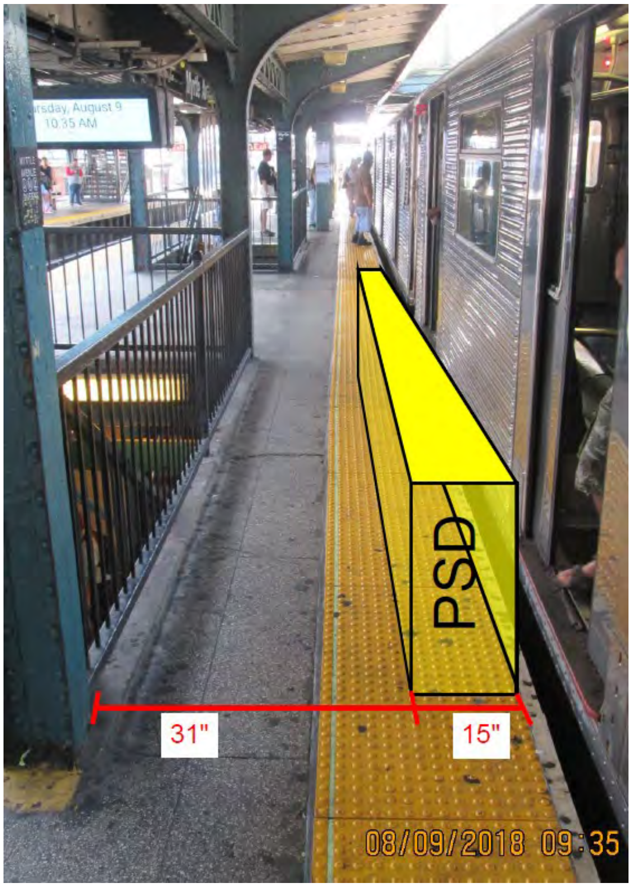

***Figure 1** – Non-Compliant ADA condition*
Myrtle Avenue-Broadway Station

1.19 – MRN 098 | Flushing Avenue Station

Summary: *Flushing Avenue Station is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.*

Description

Flushing Avenue Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 9'-2" throughout. There are two staircases at each end of the platforms. Currently the stair guardrail sits 40" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 25" would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

***Figure 1** – Non-Compliant ADA condition*
Flushing Avenue Station

1.20 – MRN 099 | Lorimer Street Station

Summary: *Lorimer Street Station is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.*

Description

Lorimer Street Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 9'-4" throughout. There are two staircases at each end of the platforms. Currently the stair guardrail sits 40" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 25" would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

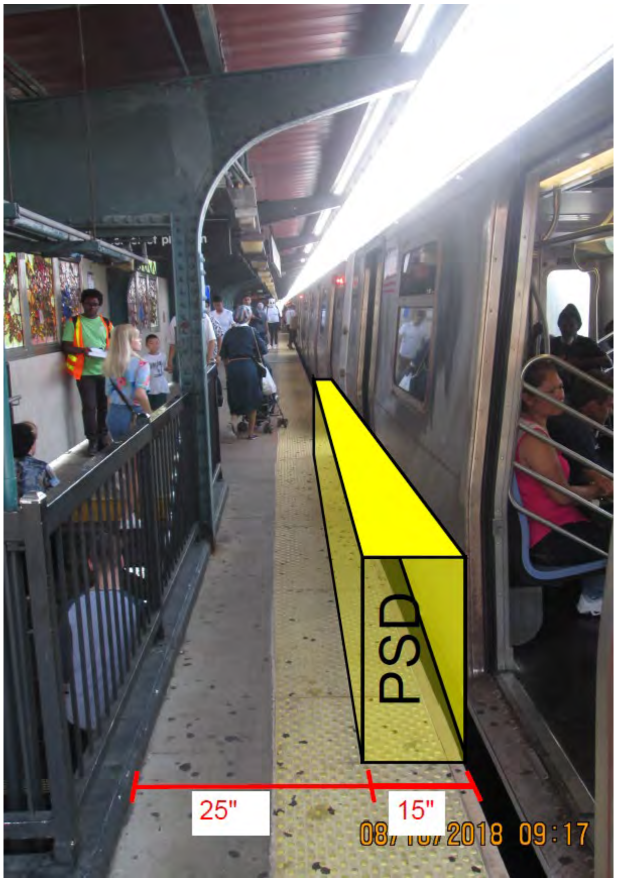

Figure 1 *– Non-Compliant ADA condition*
Lorimer Street Station

1.21 – MRN 100 | Hewes Street Station

Summary: *Hewes Street Station is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.*

Description

Hewes Street Station is an elevated station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 9'-8" throughout. There are two staircases at each end of the platforms. Currently the stair guardrail sits 40" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36" at all staircases. The remaining 25" would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

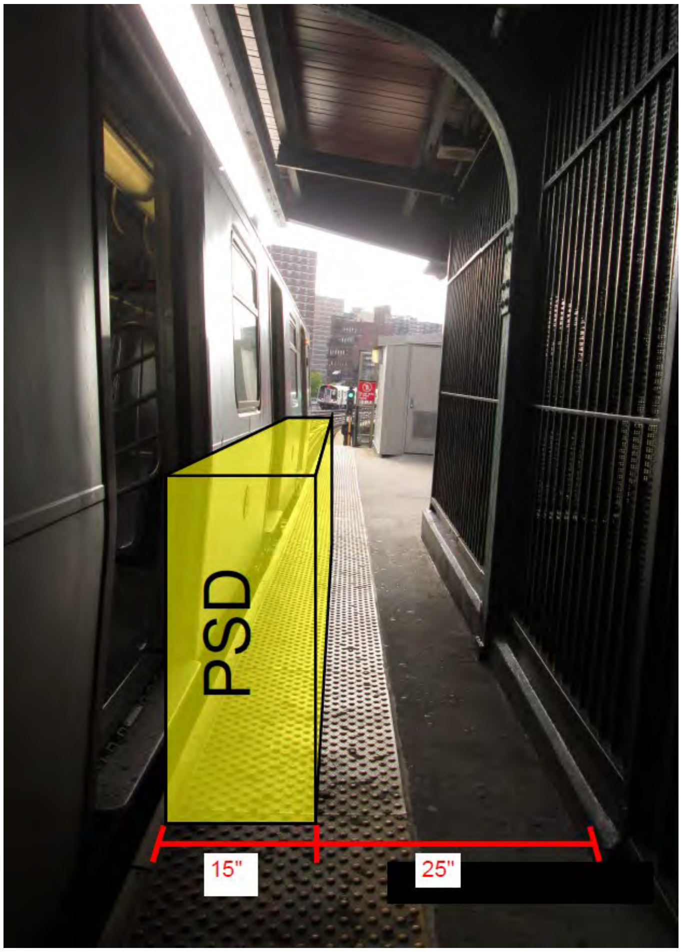

***Figure 1** – Non-Compliant ADA condition*
Hewes Street Station

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1.22 – MRN 101 | Marcy Avenue Station

Summary: *Marcy Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2).*

Description

Marcy Avenue Station is an elevated station consisting of two side platforms. The platform widths are approximately 10'-0". The platforms are straight with a row of a columns in line with the wind screen, which support the station canopy. The canopy covers a half of the platform length. See figure 1 & 2 for reference.

Figure 1 *– General Station condition*
Marcy Avenue Station

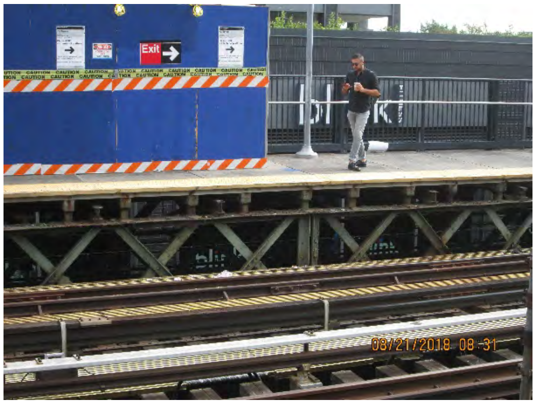

Figure 2 *– Precast Slab*
Marcy Avenue Station

1.23 – MRN 102 | Delancey Street - Essex Street Station

Summary: *Delancey Street - Essex Street Station is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.*

Description

Delancey Street - Essex Street Station is a below grade station with 1 straight center/island platforms & 1 Side platform. The platform structures are cast-in-place concrete. The width of the side platform is approximately 22-0" throughout - columns are spaced 15'-0" on center and measure 2'-8" from column face to platform edge. The width of the center/island platform is approximately 16'-4" throughout with columns spaced 15'-0" on center and measuring between 2'-6" and 3'-0" from column face to platform edge. On the center/island platform the columns flank multiple staircases and their presence would not allow for the 32" pinch-point width required for wheelchair movement with PSDs installed. At staircase PL-18 this condition is observed where the column faces measures 30" from the platform edge. The implementation of a platform edge barrier would reduce this width to 15" which would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

***Figure 1** – Non-Compliant ADA condition*
Delancey Street - Essex Street Station

1.24 – MRN 103 | Bowery Station

Summary: *Bowery Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the structural loads of an APG system (see structural report; Appendix B). Existing power is adequate.*

Description

Bowery Station is a below-grade station with one open center/island platform and one closed center/island platform **(see Figure 1)**. The platform structures are cast-in-place concrete. At the open platform columns are spaced 15'-0" on center with column faces ranging from 2'-6" to 4'-8" from the platform edge. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. The ceiling height varies throughout the station.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the closed northbound platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-0" x 6'-6".

Track Layout

Tracks are tangent. We are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures. **(See Figure 3)**

Platform Edge Condition

The platform edges were reconstructed in the 1990s. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, reconstruction of the concrete platform edge would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 3.000. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

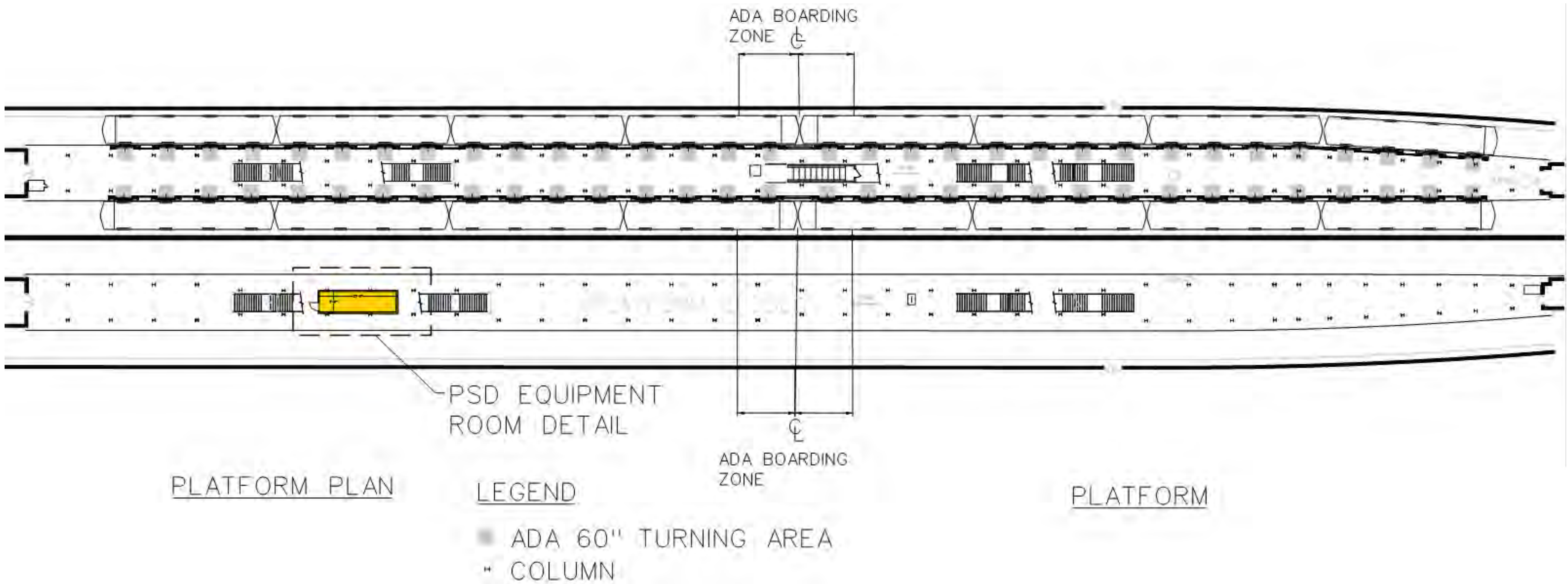

***Figure 1** – Overall Station Plan*
Bowery Station

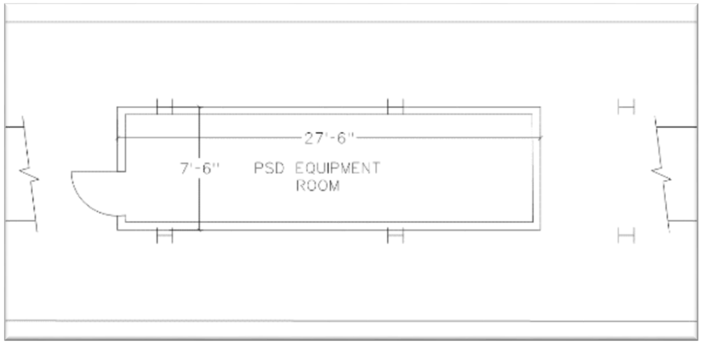

***Figure 2** – PSD Equipment Room 1 Detail*
Bowery Station

***Figure 3** – Typical platform view*
Bowery Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; perpendicular to the platform edge. Installation of APG/PSD will not affect the existing lighting configuration.

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Bowery
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	56.4
Apparent Power (kVA)	70.5
Station Peak Demand Load, Max Current, (A)	195.8
Maximum Amount of Doors	64.0
PSD Total Load Including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	361
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	439
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on 1 line diagram. The analysis is based on available one Normal meter reading. (No access to Tunnel Reserve room)

Table 1*- Power Capacity Analysis*

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $28.6M to install APGs and $35.6M to install PSDs (See Appendix E)

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1.25 – MRN 104 | Canal Street Station

Summary: *Canal Street Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG system (see structural report; Appendix B). Existing power is adequate.*

Description

Canal Street Station is a below-grade station with one open center/island platform and one closed center/island platform **(see Figure 1)**. The platform structures are cast-in-place concrete. At the open platform the platform width is approximately 19"-0" and columns are spaced 15'-0" on center with column faces measuring approximately 4'-6" from the platform edge. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. The ceiling height varies throughout the station.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the closed northbound platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-0" x 6'-6".

Track Layout

Tracks are tangent. We are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edge was reconstructed in the 1990s. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, reconstruction of the concrete platform edge would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 2.750. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'J & Z' Line Stations
(Canal Street Station)

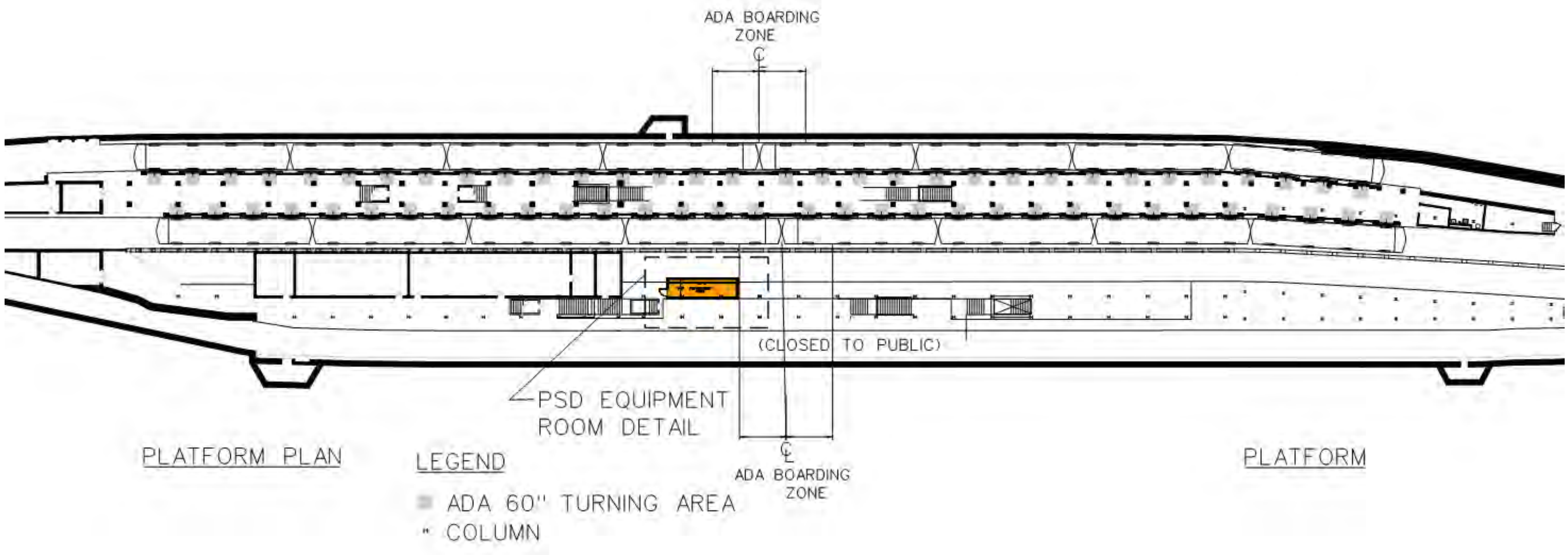

Figure 1 *– Overall Station Plan*
Canal Street Station

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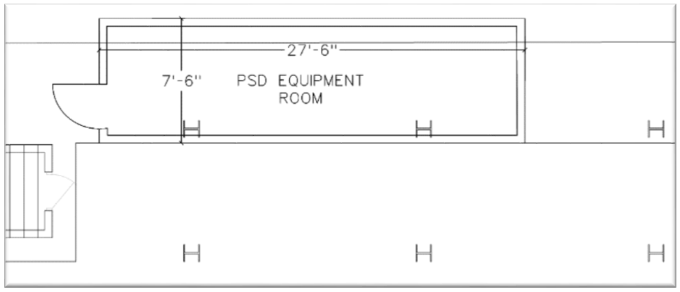

Figure 2 *– PSD Equipment Room 1 Detail*
Canal Street Station

Figure 3 *– Typical platform view*
Canal Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; perpendicular to the platform edge. Installation of APG/PSD will not affect the existing lighting configuration.

Power:
This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Canal Street
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	64.8
Apparent Power (kVA)	81.0
Station Peak Demand Load, Max Current, (A)	225.0
Maximum Amount of Doors	64.0
PSD Total Load Including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	390
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	410
Is Electrical Service Adequate?	**Yes**
	Service rating is based on 1 line diagram. The Station has only normal EDR and one Normal meter reading.

Table 1- *Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $26.6M to install APGs and $32.5M to install PSDs (See Appendix E).

1.26 – MRN 105 | Chambers Street Station

Summary: *Chambers Street Station is not feasible for both APGs and PSDs. Current conditions at various locations in this station do not meet ADA compliance requirements. The implementation of an APG/PSD system would further constrain the aforementioned non-compliant locations.*

Description

Chambers Street Station is below grade station with two active straight center/island platforms, 1 closed center/island platform and 2 closed side platforms. The platform structures are cast-in-place concrete. The width of the open platforms is approximately 22'-8" throughout. Columns are spaced 15'-0" on center and measure between 2'-6" and 3'-6" away from all platform edges. The platform columns flank multiple staircases and their presence would not allow for the 32" pinch-point width required for wheelchair movement with PSDs installed. At staircase P43A/B this condition is observed where a column face measures 40" from the platform edge. The implementation of a platform edge barrier would reduce this width to 25". See figure 1 for reference.

Figure 1 *– Non-Compliant ADA condition*
Chambers Street Station

1.27 – MRN 106 | Fulton Street Station

Summary: *Fulton Street Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG system (see structural report; Appendix B). Existing power is adequate.*

Description

Fulton Street Station is a below-grade station with two mildly curved side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 3'-4" from the platform edge. The southbound platform width varies from approximately 14'-0" to 17'-8". The northbound platform width is approximately 14'-6" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. The ceiling height varies throughout the station.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the southbound platform in a closed control area (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-0" x 6'-6".

Track Layout

Tracks are on a mild radius. Therefore, the gaps between the platform and train will slightly exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edge was reconstructed in the 1990s. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, reconstruction of the concrete platform edge would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 2. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

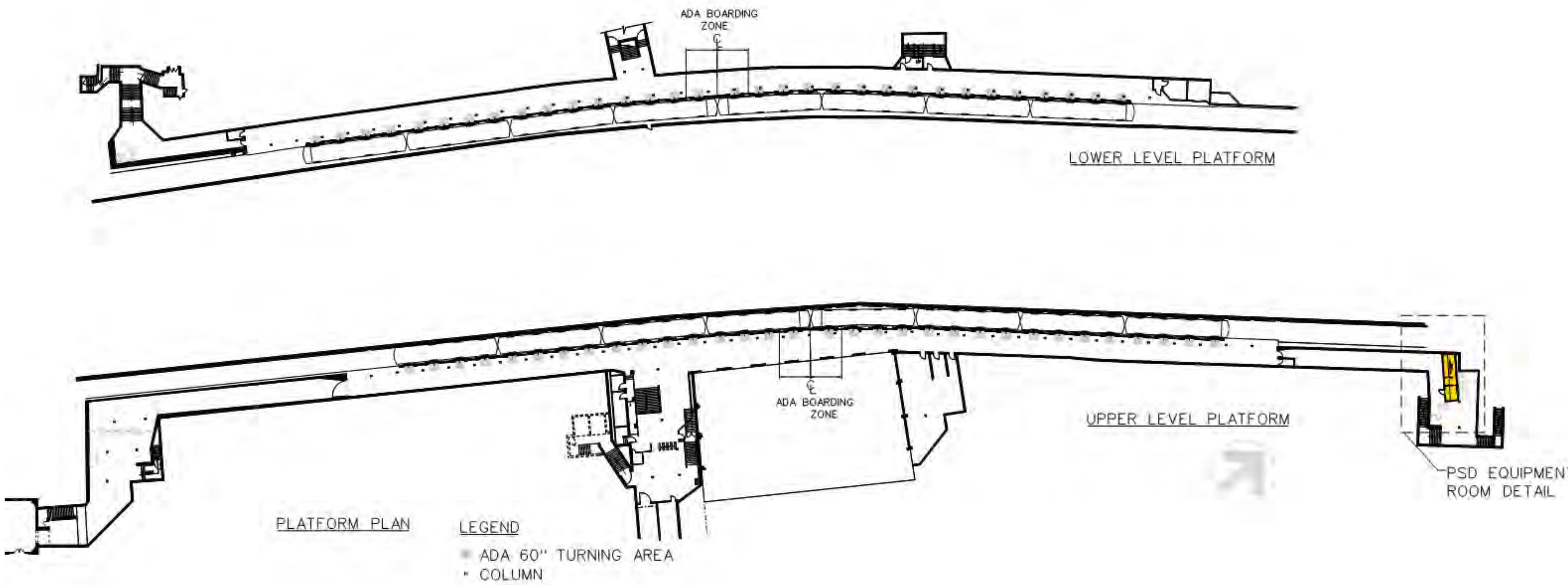

***Figure 1** – Overall Station Plan*
Fulton Street Station

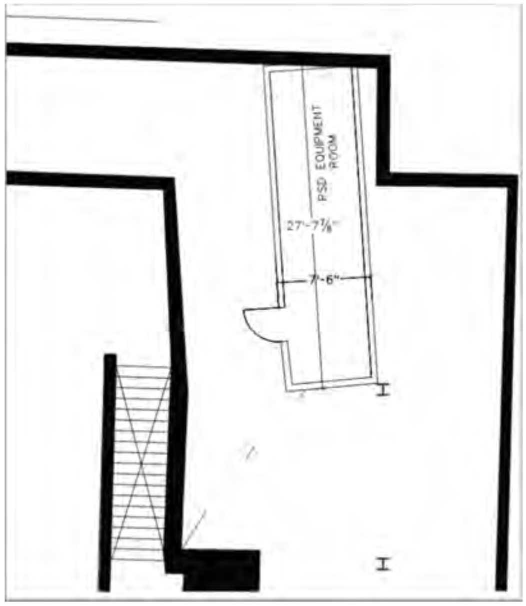

Figure 2 *– PSD Equipment Room 1 Detail*
Fulton Street Station

Figure 3 *– Typical platform view*
Fulton Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; perpendicular to the platform edge. Installation of APG/PSD will not affect the existing lighting configuration.

Power:
This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Fulton Street Bway Nassau
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	21.6
Apparent Power (kVA)	27.0
Station Peak Demand Load, Max Current, (A)	75.0
Maximum Amount of Doors	64.0
PSD Total Load Including All Miscellaneous Loads, (A)	165.4
Total Load (Station Peak + PSD), (A)	240
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	560
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram. Station has (2) separate meter readings, for each Normal & Reserve service. This analysis is for **Reserve service**.

Table 1- *Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be \$27.4M to install APGs and \$34.1M to install PSDs (See Appendix E)

1.28 – MRN 107 | Broad Street Station

Summary: *Broad Street Station is feasible for both APGs and PSDs. There are two ceiling mounted signals located above the each platform edge with a vertical clearance ranging between 7' 4" and 8'-0", which would require relocation to implement a PSD system. Platform edge reconstruction would be required to support the requirements of an APG system (see structural report; Appendix B). At the time of this report's submission, no electrical data could be ascertained. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.*

Description

Broad Street Station is a below-grade station with two mildly curved side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 3'-6" from the platform edge. The southbound platform width varies from approximately 8'-6" to 20'-0". The northbound platform width varies from approximately 10'-8" to 20'-2". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. The ceiling height varies throughout the station. Ceiling mounted signals located above the platform edge would need to be relocated in the implementation of full height PSDs.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the northbound platform, flush to the wall (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-0" x 6'-6".

Track Layout

Tracks are on a mild radius. Therefore, the gaps between the platform and train will slightly exacerbate the gap between the train doors and the PSDs. Per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edge was reconstructed in the 1990s. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, reconstruction of the concrete platform edge would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 2. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

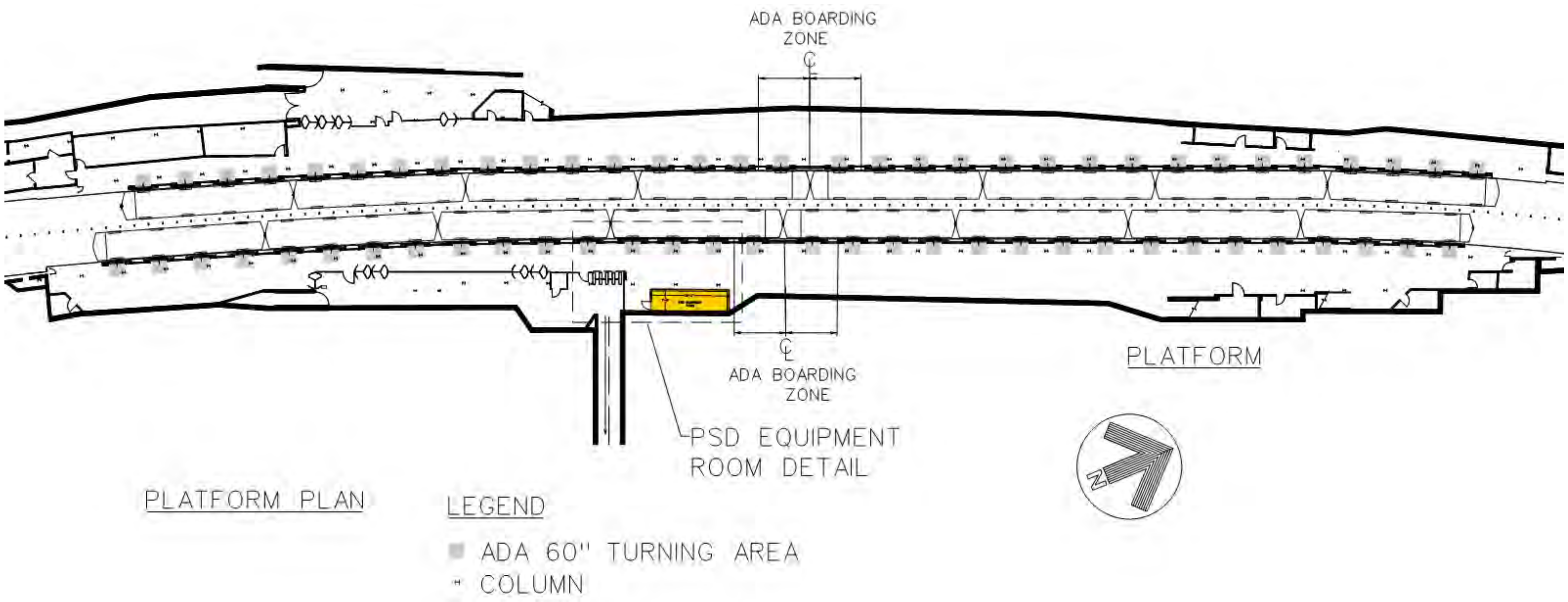

Figure 1 *– Overall Station Plan*
Broad Street Station

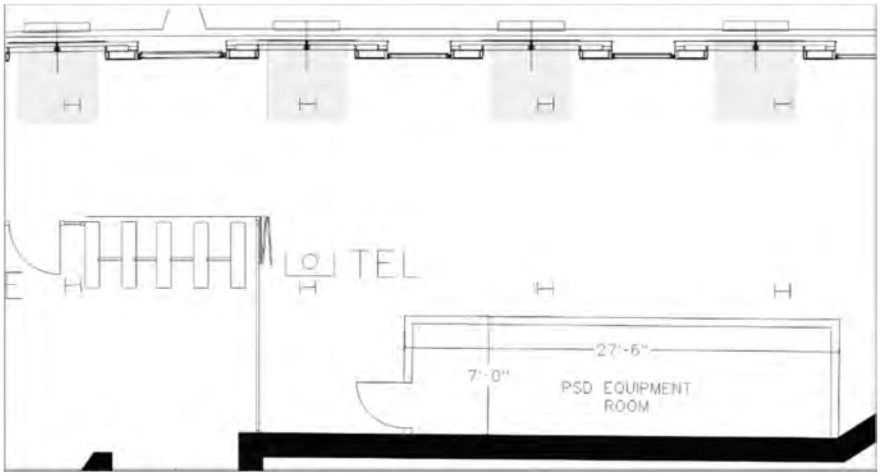

Figure 2 *– PSD Equipment Room 1 Detail*
Broad Street Station

Figure 3 *– Typical platform view*
Broad Street Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; perpendicular to the platform edge. Installation of APG/PSD will not affect the existing lighting configuration.

Power:

An analysis of adequate electrical power at this station could not be performed at the time of this report's submission. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.4M to install APGs and $34.1M to install PSDs (See Appendix E)

1.29 – MRN 278 | Jamaica Center– Parsons/Archer Station

Summary: *Parsons Boulevard Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG or a PSD system (see structural report; Appendix B). Existing power is adequate.*

Description

Jamaica Center– Parsons Archer is a below-grade station with two levels of center/island platforms **(see Figure 1)**. The platform structure is cast-in-place concrete. Back-of-house elements are located in the mezzanines, throughout the platform level (in non-public rooms) or at the platform ends away from the circulation paths. This report covers only the lower level platform as the upper level platform services the "E" line and was previously covered in the report for the "E" Line stations. There are sparsely located columns throughout the station. These columns are either centered and measure 20'-10" apart on center and their faces measure 11'-8" from the platform edges or the columns flank the escalators measure 25'-0" on center and their faces measure 4'-10" from the platform edge. The platform width is approximately 25'-0" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. The varying ceiling heights throughout the station.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room could be located at the center of the platform (**see Figure 1, Figure 2)**. The proposed room dimension is 27'-0" x 7'-6".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

Reconstruction of the concrete platform edge will be required for the installation of an APG or PSD system due to the current platform edge condition rating. The 2012 NYCT conditions survey gave the platform edges an average rating of 3.375. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'JZ' Line Stations
(Jamaica Center - Parsons/Archer Station)

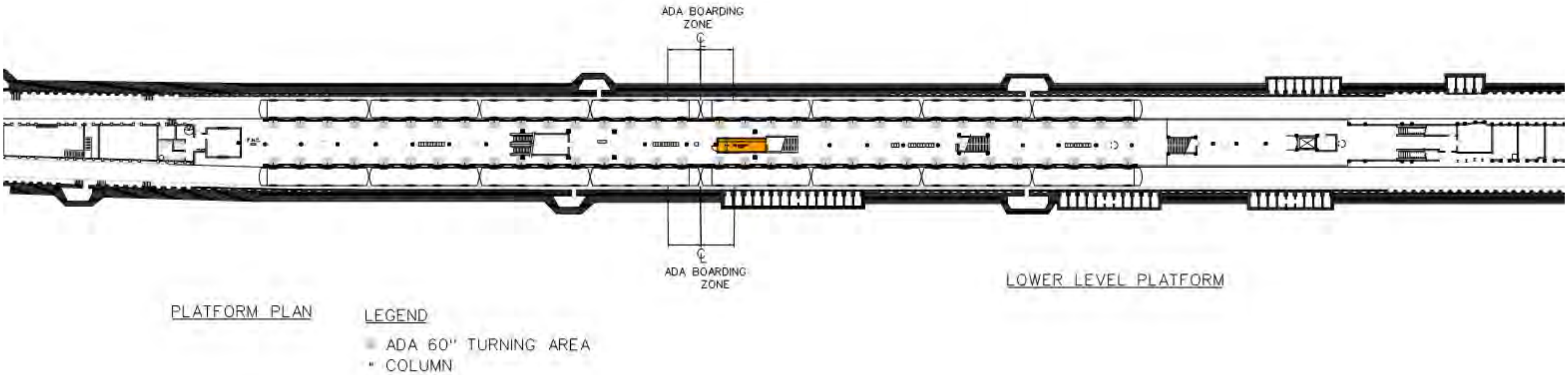

***Figure 1** – Overall Station Plan (Lower Level)*
Jamaica Center– Parsons Archer Station

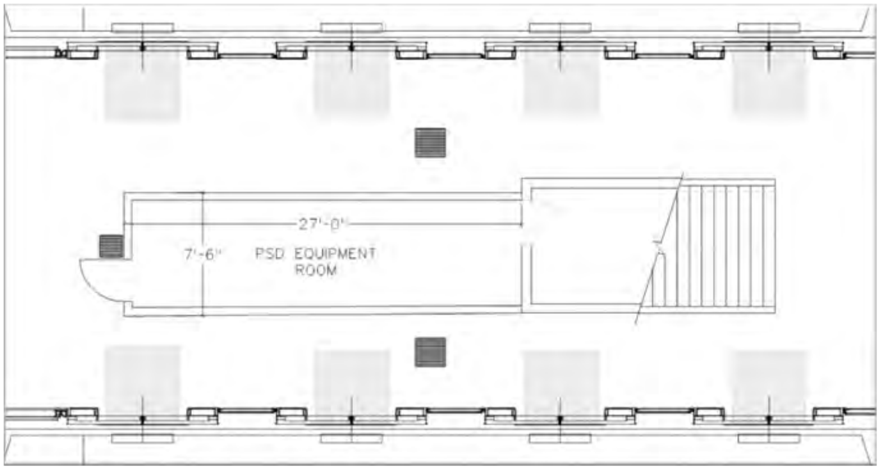

***Figure 2** – PSD Equipment Room 1 Detail*
Jamaica Center– Parsons Archer Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns at stairs and escalators

Northbound Track:

- Columns at stairs and escalators

These obstructions do not present an impediment to the installation of PSDs.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Jamaica Ctr. Parsons / Archer
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	688.3
Apparent Power (kVA)	860.4
Station Peak Demand Load, Max Current, (A)	2389.9
Maximum Amount of Doors	144.0
PSD Total Load Including All Miscellaneous Loads, (A)	317.2
Total Load (Station Peak + PSD), (A)	2707
Station Service Power Capacity, (Main SB or SG Rating), (A)	9000
Service Spare Capacity, (A)	6293
Is Electrical Service Adequate?	**Yes**
Notes	The analysis is based on field observed framed 1 line diagram located in Normal EDR. The station has only Normal EDR. The station has (2) service take offs (2 services) each at 4500 A rating and has (2) meters with combined reading.

***Table 1**- Power Capacity Analysis*

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $30.2M to install APGs and $38.8M to install PSDs (See Appendix E)

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***Figure 3** – Typical platform view*
Jamaica Center– Parsons Archer Station

1.30 – MRN 279 | Sutphin Boulevard Station

Summary: *Sutphin Boulevard Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG or a PSD system (see structural report; Appendix B). Existing power is adequate*

Description

Sutphin Boulevard Station is a below-grade station with two levels of center/island platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Back-of-house elements are located in the mezzanines or at the platform ends away from the circulation paths. This report only covers the lower level platform as the upper level platform services the "E" line and was previously covered in the report for the "E" Line stations. At the lower level platform column faces typically measure 4'-10 from the platform edge. The platform width varies from 20'-5" to 33'-9" throughout save for a slight taper to 14'-3" at the western end. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, standard NYCT wayfinding signage and the varying ceiling heights throughout the station. **(See figure 3).**

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room could be located at the end of the platform (**see Figure 1, Figure 2)**. The proposed room dimension is 27'-0" x 6-6".

Track Layout

Tracks are nearly tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

Reconstruction of the concrete platform edge will be required for the installation of an APG or PSD system due to the current platform edge condition rating. The 2012 NYCT conditions survey gave the platform edges an average rating of 2.875. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'JZ' Line Stations
(Sutphin Boulevard Station)

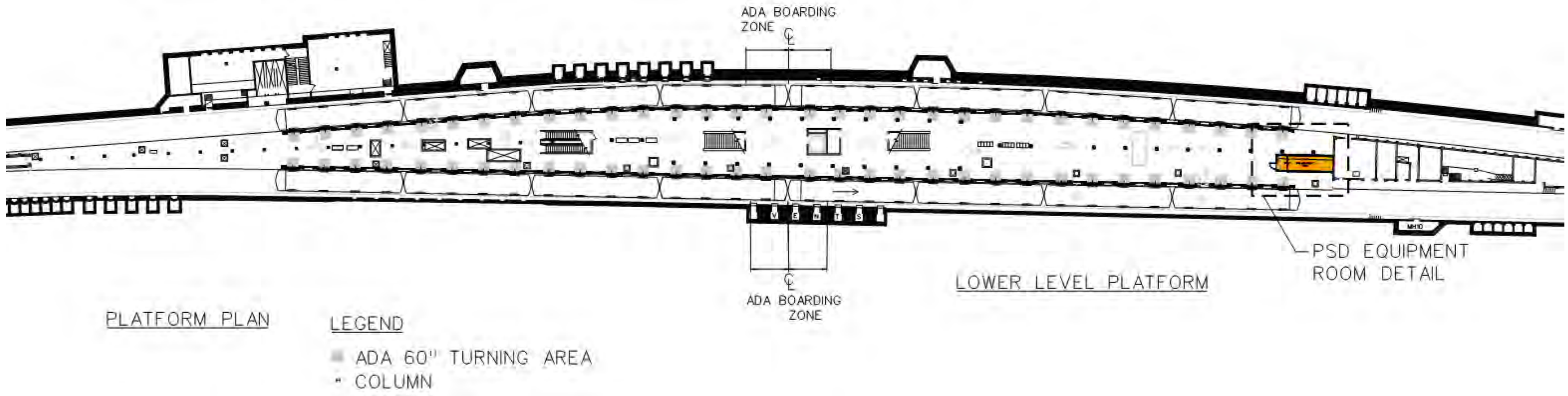

***Figure 1** – Overall Station Plan*
Sutphin Boulevard Station

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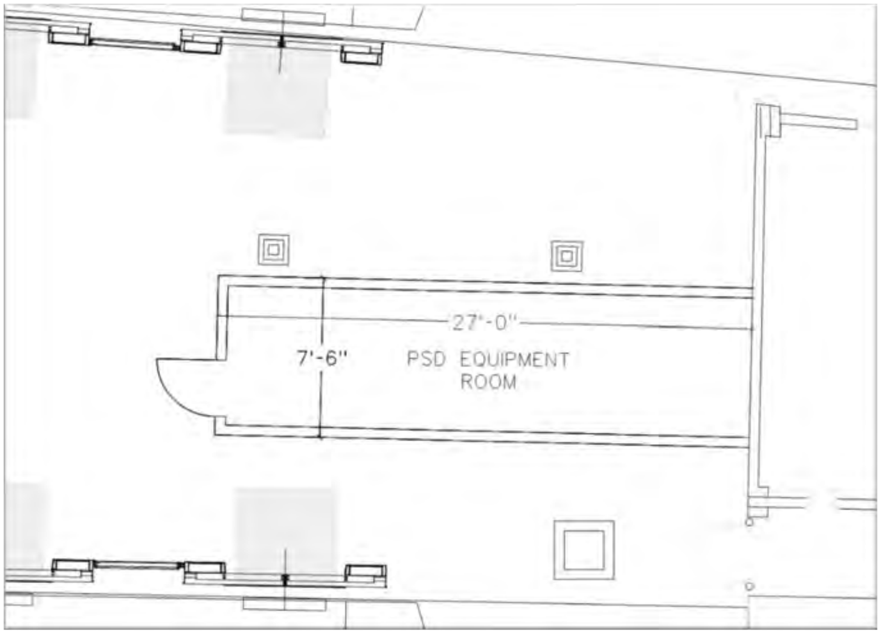


***Figure 2** – PSD Equipment Room 1 Detail*
Sutphin Boulevard Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones there are existing conditions where there are columns obstructing the 60" circle requirement discussed in the ADA summary in Appendix A, the installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:
This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Sutphin Blvd Archer Ave
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	520.0
Apparent Power (kVA)	650.0
Station Peak Demand Load, Max Current, (A)	1805.8
Maximum Amount of Doors	144.0
PSD Total Load Including All Miscellaneous Loads, (A)	317.2
Total Load (Station Peak + PSD), (A)	2123
Station Service Power Capacity, (Main SB or SG Rating), (A)	17705.33
Service Spare Capacity, (A)	15582
Is Electrical Service Adequate?	**Yes**
	Station Normal EDR has (2) separate 460 Volt Services each with its own meter & combined meter reading. The rating data is converted to 208 V units. Reserve EDR has (1) service rated at 208 V. The meter reading is zero. The analysis is based on Normal service field observations.

Table 1*- Power Capacity Analysis*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $30.1M to install APGs and $38.8M to install PSDs (See Appendix E)

***Figure 4** – Typical platform view*
Sutphin Boulevard Station

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*
>
> a. *Column location in relation to the platform edge*
> b. *Platform edge clearance adjacent to stairs and other impediments*
> c. *Impacts to ADA path of travel and boarding areas*
> d. *Conflicts of PSD/APG/RPSDs with Signals cables*
> e. *Sufficient platform width*
> f. *Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*
>
> a. *Structural capacity of platforms to accept PSD/APG/RPSDs*
> b. *Feasibility & location for PSD/APG/RPSDs equipment room*
> c. *Confirmation of adequate power for PSD/APG/RPSDs*
> d. *Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> e. *Determination of communications requirements, availability and cost*
> f. *Determination of gap detection and entrapment avoidance technology requirements*
> g. *Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
   - Double the amount of motors as PSDs (each motor operating a single leaf).
   - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
   - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
   - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	Comments
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY. Status of doors will be provided to crew via indicator lights, with no automated propulsion cutout.

If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	**Dedicated Loop**	**Wayside Only**
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

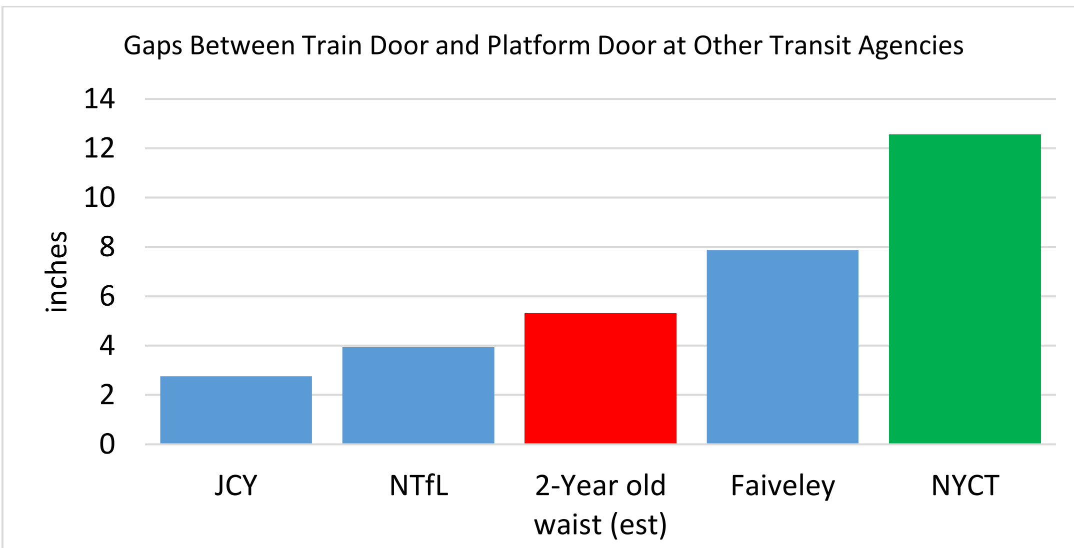


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

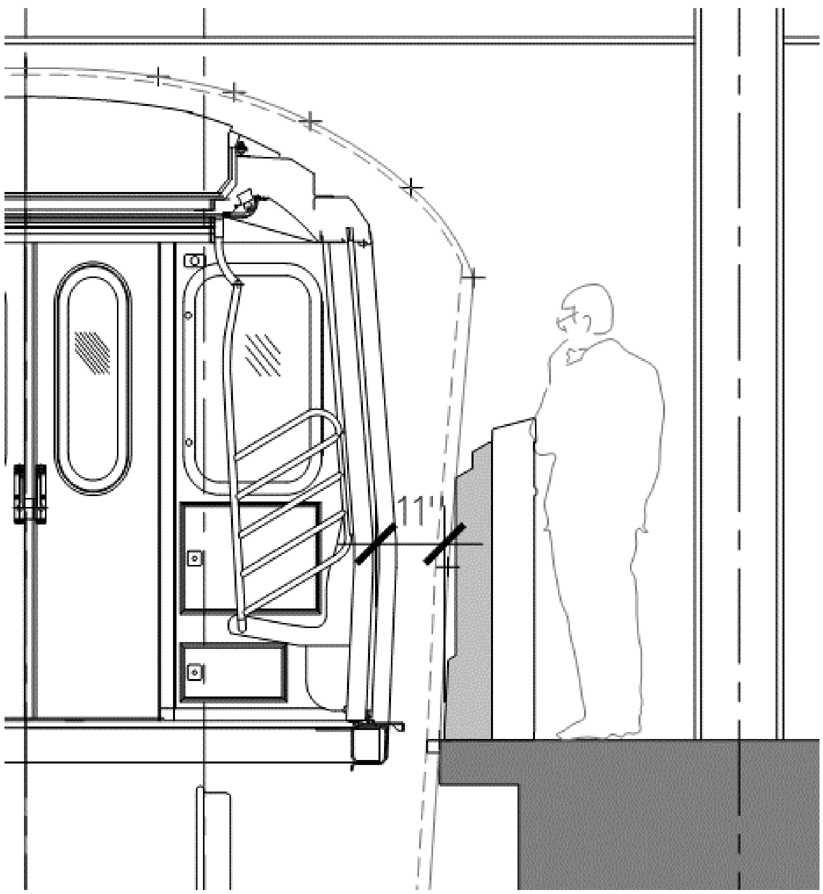


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber "bumpers" on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6" into the line equipment envelope. This would leave a 5" gap between the platform and car doors allowing approximately 2" of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5" by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor's window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor's window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **<u>bold/underline</u>**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	PSD System 1	PSD System 2	PSD System 3
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are “existing” as defined by code. All the rolling stock is also to be considered “existing” under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60” radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36” of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

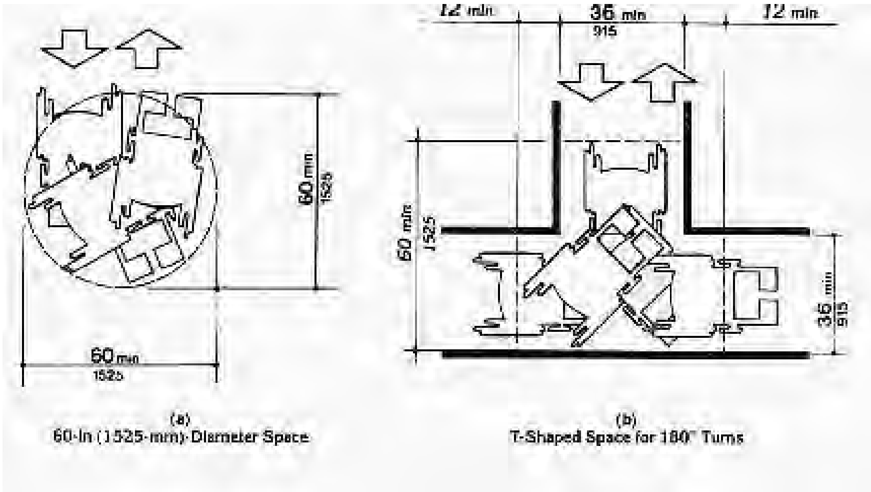
Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

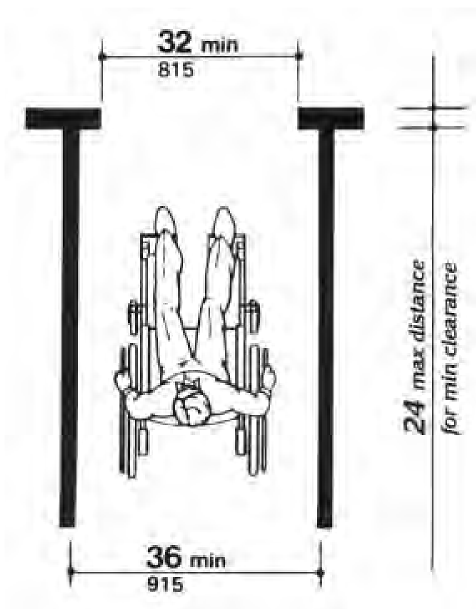


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

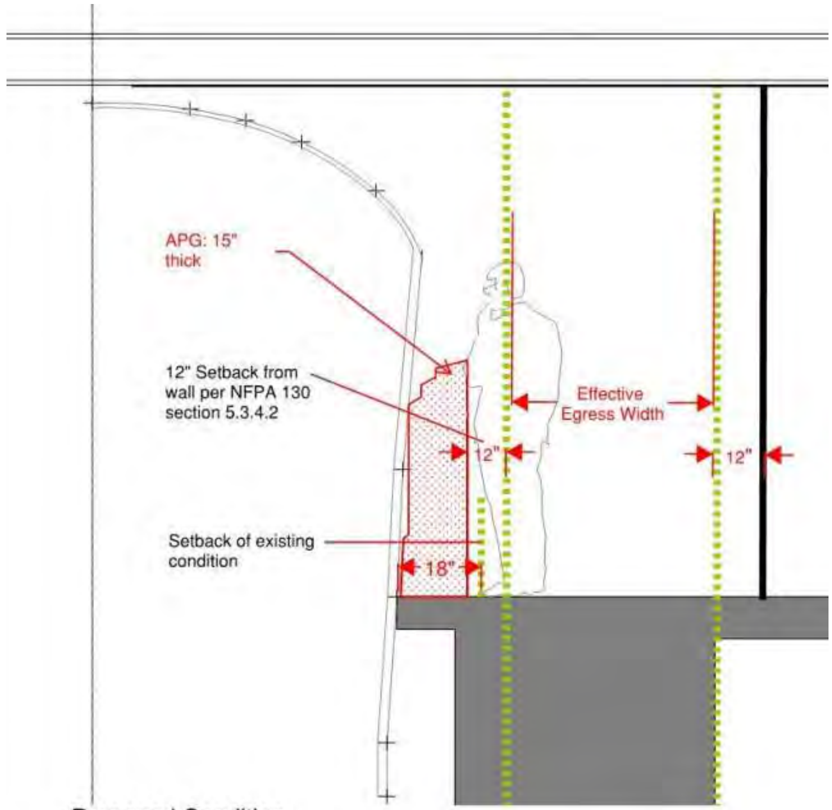
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15" of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

Table of Contents

Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

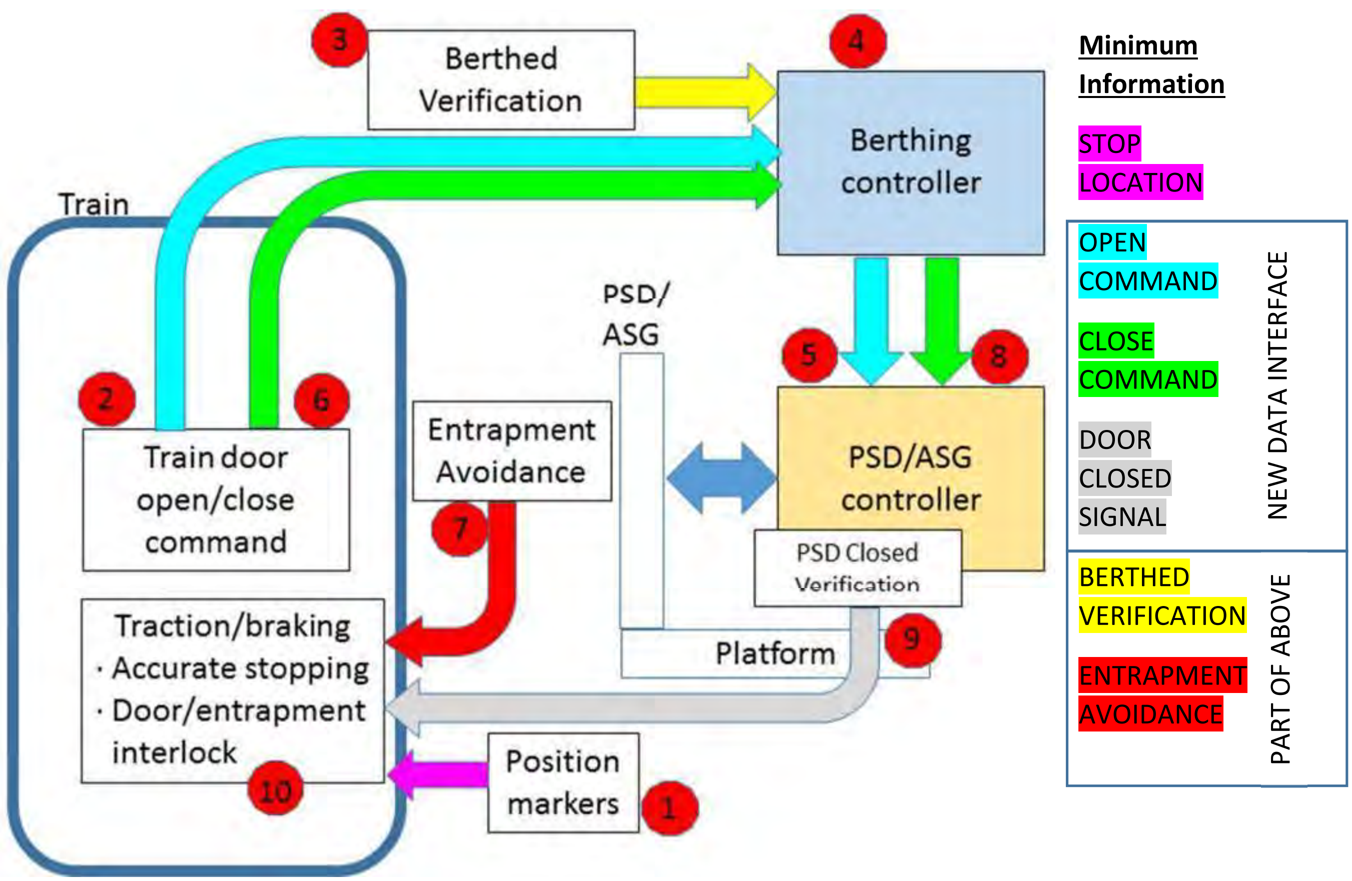
1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

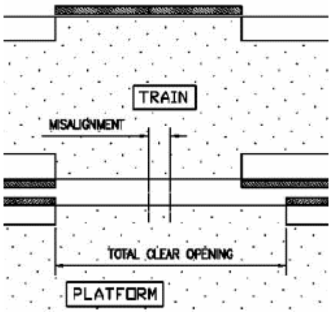
General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.
B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.
C. Dwell during passenger boarding/alighting
D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.
E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5" clear opening, a design for NY should meet the ADA Accessibility Guideline of 36".

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a 'distance totem' which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy's COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically

If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.

For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4'-0"). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

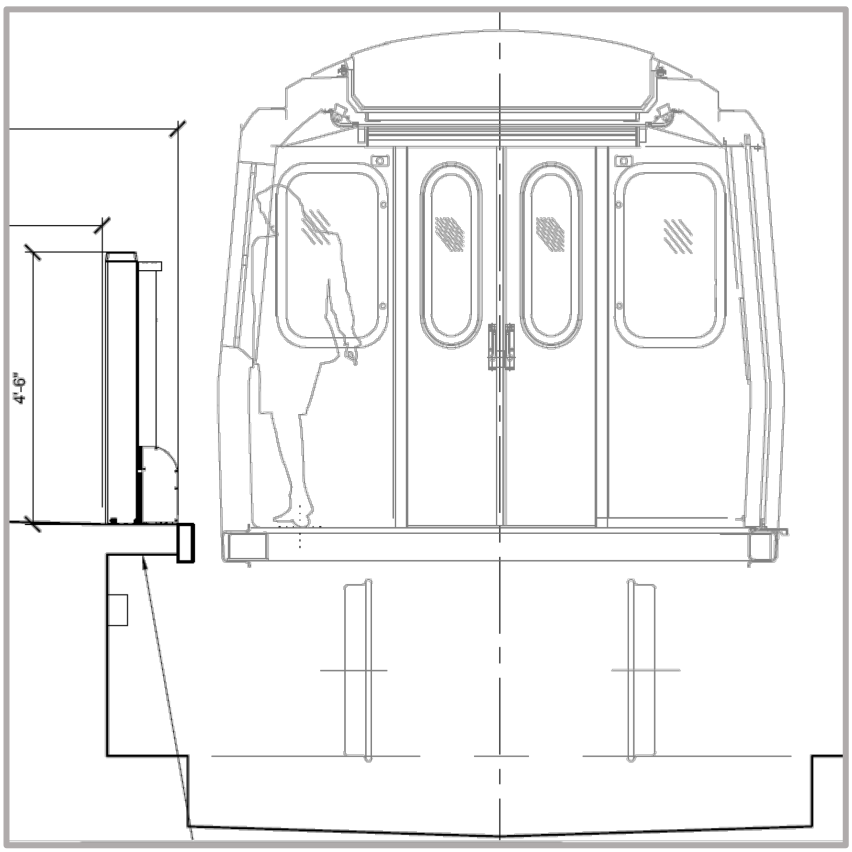


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

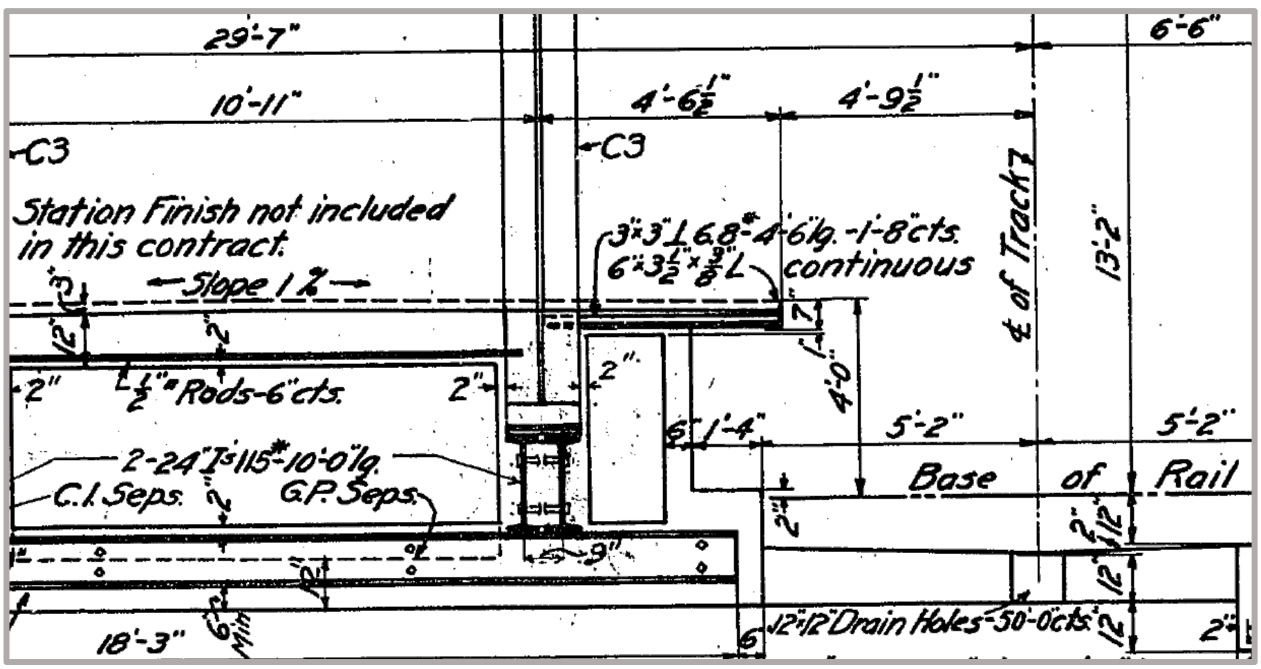


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

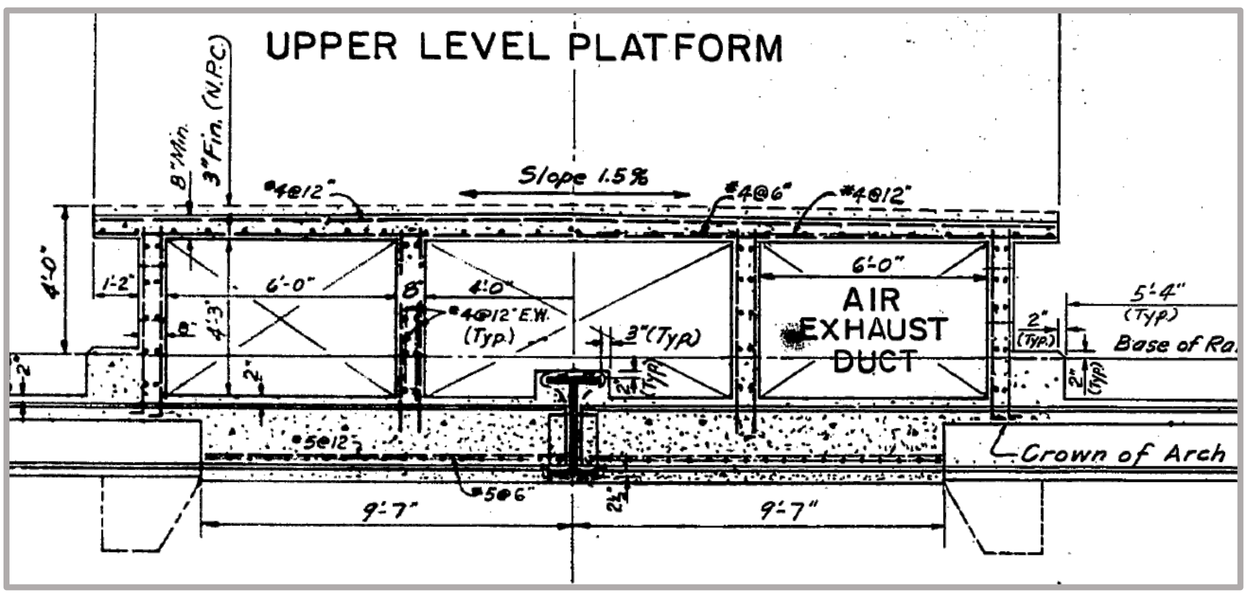


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

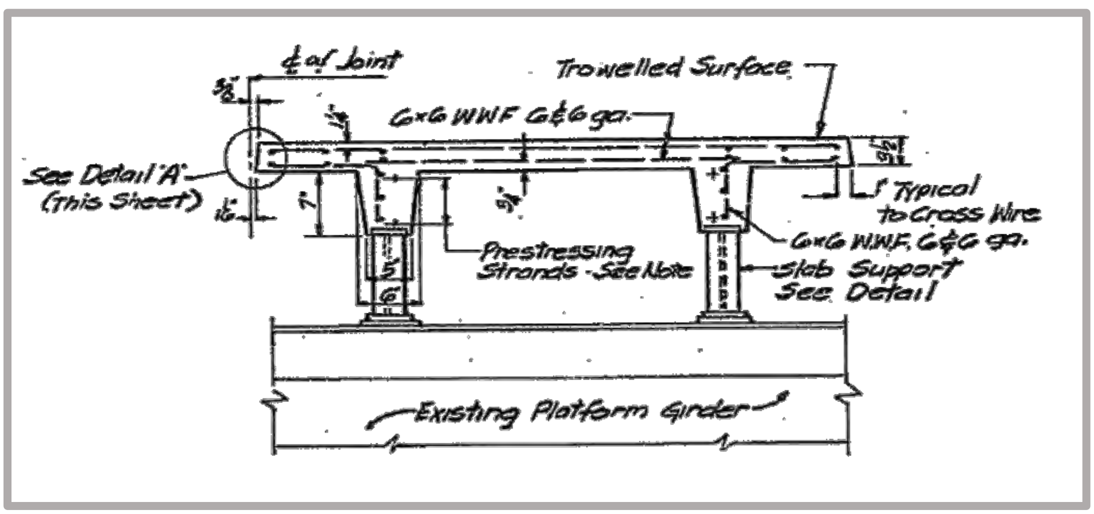


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

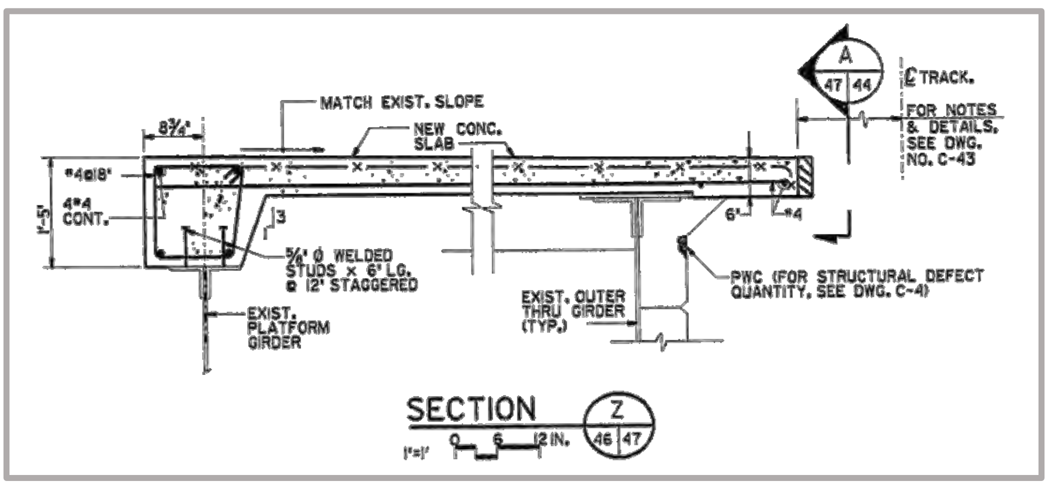


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2'-9"), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

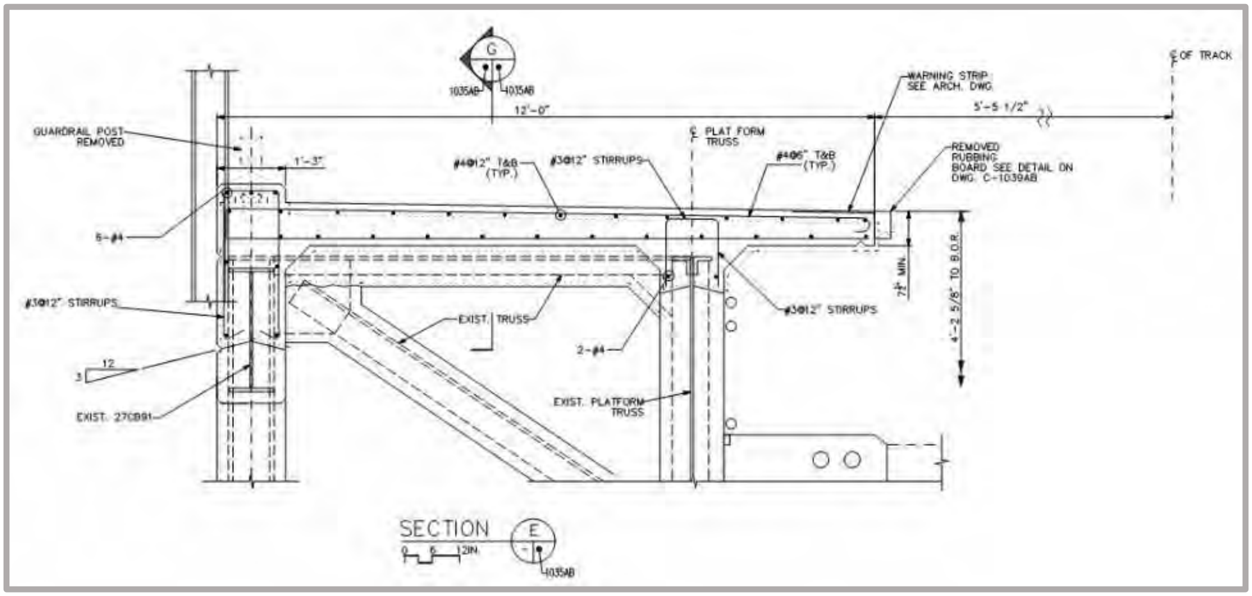


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3" thick structural slab with an approximately 3" thick topping slab. If the topping slab is fully removed, a 6" thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6" thick slab will be sufficient for a cantilever length of up to approximately 3'-0", greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6" structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6" minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

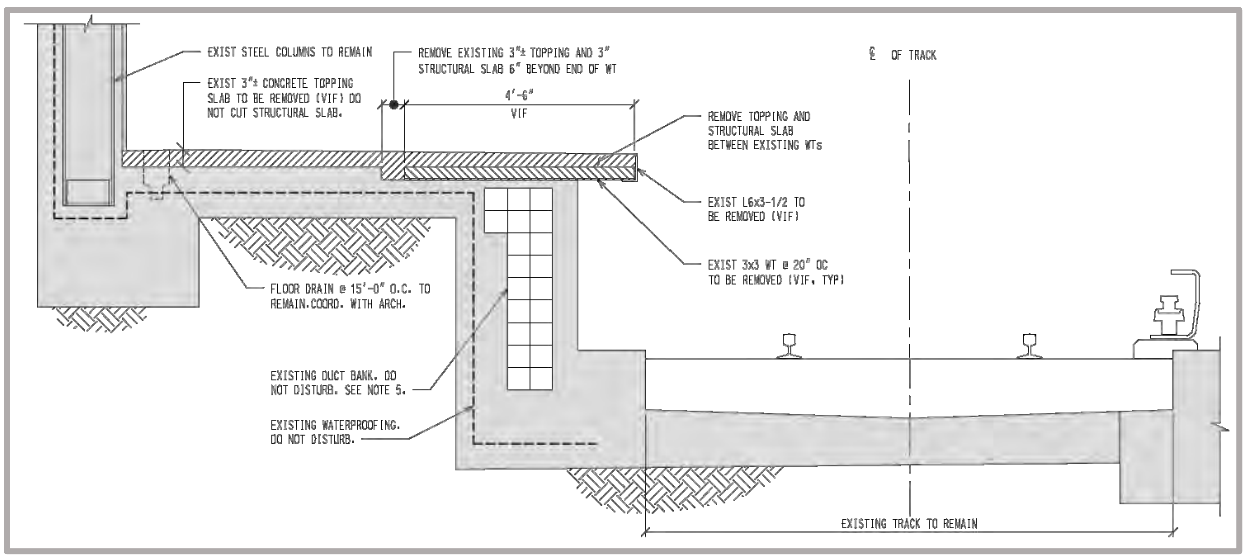


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

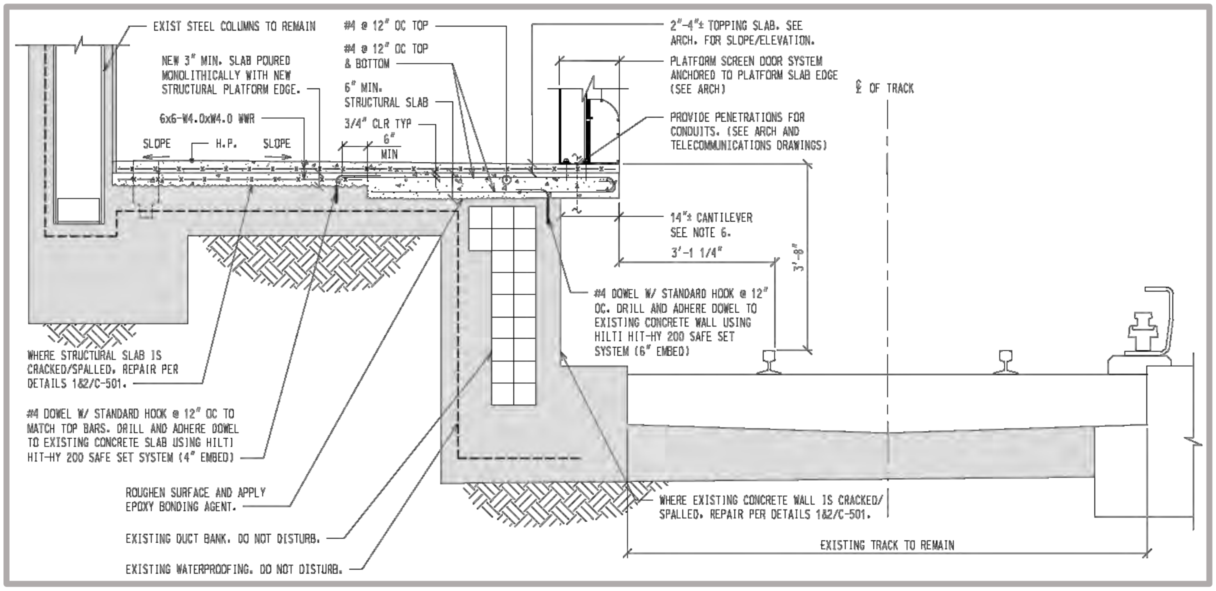


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

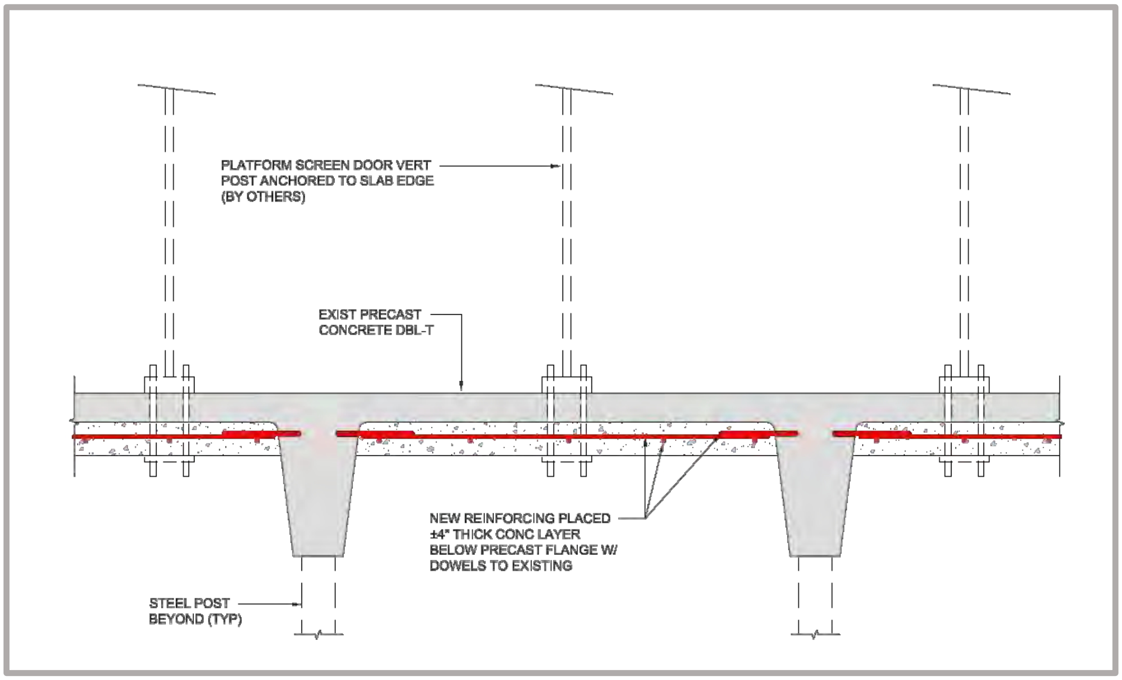


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5' – 11" of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis

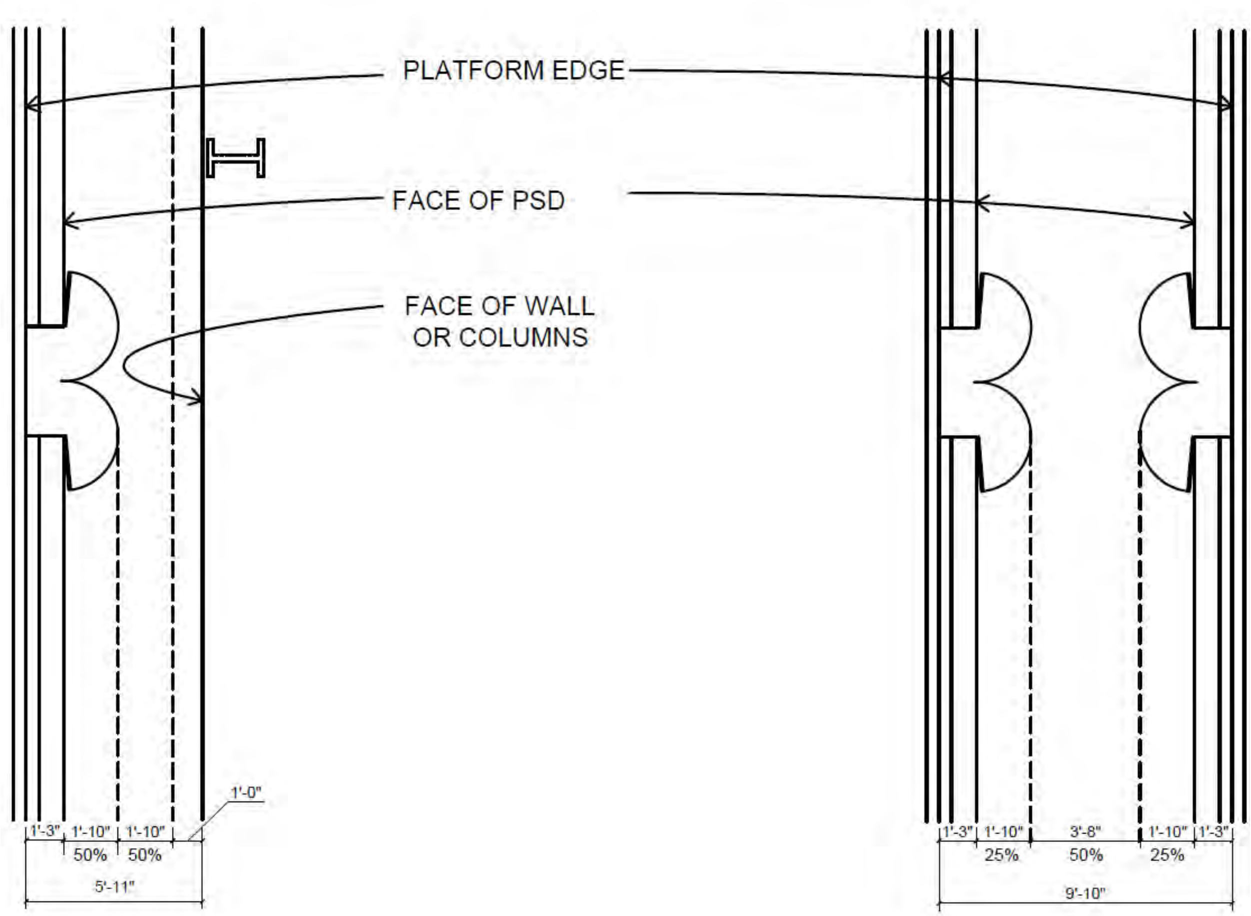


FIGURE 1: SIDE PLATFORM

FIGURE 2: CENTER PLATFORM

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

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MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the	9	$ 63,500 per month [Year 01]	$ 571,500		
	platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance	12	$ 83,590 per month [Year 02]	$ 1,003,080		
	since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
	remedial repair performed as needed, 24/7, for the	12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
	platform screen door system and ancillary equipment.					
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663

	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663

7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *	
		Year 3	$ 257 per hour *	
	Optional :	Year 4	$ 268 per hour *	
	Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32514
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations
ESTIMATE DATE:	October 15, 2018

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

MTA/NYCT

October 15, 2018

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.2 *APGs / PSDs will provide 31 emergency egress doors with push bars per platform*
1.3 *Each platform edge will have 40 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 It is assumed that each train has 8 cars on this line
2.2 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.3 In respect of the PSD option, only platforms that have not been upgraded in the recent past will require platform edge replacement.
2.4 There are no special security requirements made necessary by installation of the APG system
2.5 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.6 This estimate does not provide for the replacement of Platform Edge Lighting
2.7 Premium cost for night time work is considered 50% of total labor cost

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VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1080

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

MTA/NYCT

October 15, 2018

BASIS OF ESTIMATE

3.0 *Exclusions - Costs not included in the estimate:*

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems
3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length
3.4 Costs associated with NYCT State Of Good Repair improvements to the station
3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.
3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs
3.7 Escalation Cost is not included; Anticipate at 5% per annum.
3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.
3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium
3.10 NYCT project cost is not included
3.11 GO and flagging cost is not included
3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 *Below the line or “soft” costs:*

4.1 Design and Construction Contingency
4.2 Contractor O & P
4.3 Insurance
4.4 NYCT project costs not included

5.0 *Additional Notes*

5.1 Given the limited time available, no drawings were developed to support this estimate.

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MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations
IRT Flushing Line Stations

October 15, 2018

	ORDER OF MAGNITUDE COSTS		MR-103	MR-104	MR-106	MR-107	MR-278.1	MR-279.1
	DESCRIPTION		BOWERY	CANAL STREET	FULTON STREET BWAY NASSAU	BROAD STREET	JAMAICA CTR. PARSONS / ARCHER	SUTPHIN BLVD ARCHER AVE
1	AUTOMATIC PLATFORM GATES (APG'S)		$15,155,408	$13,938,142	$14,523,825	$14,546,839	$15,991,110	$15,977,660
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$15,155,408	$13,938,142	$14,523,825	$14,546,839	$15,991,110	$15,977,660
4	GENERAL REQUIREMENTS	15.00%	$2,273,311	$2,090,721	$2,178,574	$2,182,026	$2,398,667	$2,396,649
	SUB-TOTAL:		$17,428,719	$16,028,864	$16,702,398	$16,728,864	$18,389,777	$18,374,309
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,357,180	$4,007,216	$4,175,600	$4,182,216	$4,597,444	$4,593,577
	SUB-TOTAL:		$21,785,898	$20,036,079	$20,877,998	$20,911,081	$22,987,221	$22,967,887
6	OVERHEAD & PROFIT	15.00%	$3,267,885	$3,005,412	$3,131,700	$3,136,662	$3,448,083	$3,445,183
	SUB-TOTAL:		$25,053,783	$23,041,491	$24,009,698	$24,047,743	$26,435,304	$26,413,070
7	BONDS & INSURANCE	3.75%	$939,517	$864,056	$900,364	$901,790	$991,324	$990,490
	SUB-TOTAL:		$25,993,300	$23,905,547	$24,910,061	$24,949,533	$27,426,628	$27,403,560
	SUB-TOTAL:		$25,993,300	$23,905,547	$24,910,061	$24,949,533	$27,426,628	$27,403,560
	SUBTOTAL CONSTRUCTION COST W/O ACM		$25,993,300	$23,905,547	$24,910,061	$24,949,533	$27,426,628	$27,403,560
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		$25,993,300	$23,905,547	$24,910,061	$24,949,533	$27,426,628	$27,403,560
10	DESIGN CONSULTANT FEES	10.00%	$2,599,330	$2,390,555	$2,491,006	$2,494,953	$2,742,663	$2,740,356
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST		$28,592,630	$26,296,102	$27,401,068	$27,444,486	$30,169,290	$30,143,916
	ADD ALTERNATIVES							
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		3,696,240	3,275,819	3,533,893	3,544,151	4,592,643	4,573,132
	Add for Markups (as above)	88.66%	3,277,193	2,904,436	3,133,252	3,142,347	4,071,970	4,054,671
			$6,973,432	$6,180,255	$6,667,145	$6,686,497	$8,664,612	$8,627,802

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : BOWERY

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE LOWER PLATFORM EDGE [SOUTH BOUND] =	527	LF		
5	LENGTH OF THE LOWER PLATFORM EDGE [NORTH BOUND] =	527	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,054	LF		
7	NUMBER OF TRAIN CARS ON THIS LINE =	8	CARS		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,054	LF	7	7,378
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,270	SF	12	63,240
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	106	CY	2,500	265,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,056	EA	25	26,400
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,056	EA	25	26,400
19	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
20	Polyethylene edge strip	1,054	LF	95	100,130
21	Provide sleeves for HV & LV wires	264	EA	110	29,040
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,054	LF	15	15,810
26	Remove existing platform tiles	1,054	LF	12	12,648
27	Sawcut existing topping concrete at perimeter of removal area	1,054	LF	5	5,270
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,324	SF	8	50,592
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,054	SF	15	15,810

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : BOWERY

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	384	LF	110	42,240
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	Equipment Room [6'-6" x 27'-6"]				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	68	LF	90	6,120
39	CMU Wall for equipment room	680	SF	45	30,600
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	179	SF	30	5,363
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	680	SF	40	27,200
45	Mosaic Band to match existing - Assuming 8" high	68	LF	120	8,160
46	Concrete cove to match existing	68	LF	20	1,360
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	179	SF	15	2,681
49	Allow for 4" thick concrete pads for equipment	45	SF	20	894
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	Automatic Platform Gates [APGs] - 4'-6" High				
56	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	10,500	651,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,106	SF	750	1,579,500
61	Spare Parts - Approx. 10% of Material Cost	1	LS	196,950	196,950
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,500,000	1,500,000
64	Allowance for Braille Signage	64	EA	2,500	160,000
65					
66	Electrical				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : BOWERY

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,054	LF	60	63,240
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	300	LF	60	18,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	350	LF	60	21,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	Communications				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : BOWERY

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,497,402	3,497,402
113	TOTAL PSD WORK:				$ 15,155,408

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (8 Cars x 4 Doors =32 No. per platform)	64	EA	25,000	1,600,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	15,000	930,000
123	Double egress/service gate in the center of the platform; #1 per Platform	4	EA	30,000	120,000
124	Platform End Gates (PEGs)	8	EA	18,000	144,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,526	SF	750	3,394,293
126	Spare Parts - Approx. 10% of Material Cost	1	LS	371,298	371,298
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	70,160
129	L6x6x1/2 continuous angle	8	TONS	17,500	135,755
130	Drilling and bolting - 4 bolts at each connection	422	EA	216	91,066
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135					
136	OMIT				
137	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	(64)	EA	15,000	(960,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	(62)	EA	10,500	(651,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
141	Fixed Panels including framing and support; 4'-6" High	(2,106)	SF	750	(1,579,500)
142	Spare Parts - Approx. 10% of Material Cost	(1)	LS	196,950	(196,950)

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : BOWERY

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
143	Platform Edge Reconstruction work	(1)	LS	473,200	(473,200)
144	Remove allowance for cast in sleeves for LV & HV power	(264)	EA	110	(29,040)
145	Conduit running under Platform Edge	(1,054)	LF	30	(31,620)
146					
147	Allow loss of production to work at night say 50%	1	LS	852,978	852,978
148					
149	PREMIUM ASSOCIATED WITH PSD's				3,696,240

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : CANAL STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	480	LF		
5	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	480	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	960	LF		
7	NUMBER OF TRAIN CARS ON THIS LINE =	8	CARS		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	960	LF	7	6,720
14	Remove 5' wide section of 3" deep structural slab to platform edge	4,800	SF	12	57,600
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	97	CY	2,500	242,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	962	EA	25	24,050
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	962	EA	25	24,050
19	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
20	Polyethylene edge strip	960	LF	95	91,200
21	Provide sleeves for HV & LV wires	264	EA	110	29,040
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	960	LF	15	14,400
26	Remove existing platform tiles	960	LF	12	11,520
27	Sawcut existing topping concrete at perimeter of removal area	960	LF	5	4,800
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	5,760	SF	8	46,080
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	960	SF	15	14,400

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : CANAL STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	384	LF	110	42,240
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	Equipment Room [6'-6" x 27'-6"]				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,645
39	CMU Wall for equipment room	405	SF	45	18,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	179	SF	30	5,363
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	405	SF	40	16,200
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,860
46	Concrete cove to match existing	41	LF	20	810
47	Interior Wall Finish - Paint	405	SF	5	2,025
48	Allow for Misc. floor & ceiling finishes	179	SF	15	2,681
49	Allow for 4" thick concrete pads for equipment	45	SF	20	894
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	Automatic Platform Gates [APGs] - 4'-6" High				
56	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	10,500	651,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	1,683	SF	750	1,262,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	177,915	177,915
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	64	EA	2,500	160,000
65					
66	Electrical				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : CANAL STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	960	LF	60	57,600
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	200	LF	60	12,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	250	LF	60	15,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	Communications				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : CANAL STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,216,494	3,216,494
113	TOTAL PSD WORK:				$ 13,938,142

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	64	EA	25,000	1,600,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	62	EA	15,000	930,000
123	Double egress/service gate in the center of the platform; #1 per Platform	4	EA	30,000	120,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	3,774	SF	750	2,830,293
126	Spare Parts - Approx. 10% of Material Cost	1	LS	333,138	333,138
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	64,019
129	L6x6x1/2 continuous angle	7	TONS	17,500	123,648
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135					
136	OMIT				
137	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	(64)	EA	15,000	(960,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(62)	EA	10,500	(651,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
141	Fixed Panels including framing and support; 4'-6" High	(1,683)	SF	750	(1,262,250)

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : CANAL STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Spare Parts - Approx. 10% of Material Cost	(1)	LS	177,915	(177,915)
143	Platform Edge Reconstruction work	(1)	LS	440,360	(440,360)
144	Remove allowance for cast in sleeves for LV & HV power	(264)	EA	110	(29,040)
145	Conduit running under Platform Edge	(960)	LF	30	(28,800)
146					
147	Allow loss of production to work at night say 50%	1	LS	755,958	755,958
148					
149	PREMIUM ASSOCIATED WITH PSD's				3,275,819

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : FULTON STREET BWAY NASSAU

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	530	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	530	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,060	LF		
7	NUMBER OF TRAIN CARS ON THIS LINE =	8	CARS		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,060	LF	7	7,420
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,300	SF	12	63,600
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	107	CY	2,500	267,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,062	EA	25	26,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,062	EA	25	26,550
19	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
20	Polyethylene edge strip	1,060	LF	95	100,700
21	Provide sleeves for HV & LV wires	264	EA	110	29,040
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,060	LF	15	15,900
26	Remove existing platform tiles	1,060	LF	12	12,720
27	Sawcut existing topping concrete at perimeter of removal area	1,060	LF	5	5,300
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,360	SF	8	50,880
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,060	SF	15	15,900

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : FULTON STREET BWAY NASSAU

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	384	LF	110	42,240
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [6'-6" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	68	LF	90	6,120
39	CMU Wall for equipment room	680	SF	45	30,600
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	179	SF	30	5,363
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	680	SF	40	27,200
45	Mosaic Band to match existing - Assuming 8" high	68	LF	120	8,160
46	Concrete cove to match existing	68	LF	20	1,360
47	Interior Wall Finish - Paint	680	SF	5	3,400
48	Allow for Misc. floor & ceiling finishes	179	SF	15	2,681
49	Allow for 4" thick concrete pads for equipment	45	SF	20	894
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	10,500	651,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,133	SF	750	1,599,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	198,165	198,165
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	64	EA	2,500	160,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : FULTON STREET BWAY NASSAU

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,060	LF	60	63,600
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	200	LF	60	12,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	250	LF	60	15,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	Communications				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : FULTON STREET BWAY NASSAU

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,351,652	3,351,652
112					
113	TOTAL PSD WORK:				$ 14,523,825

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	15,000	930,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,574	SF	750	3,430,293
126	Spare Parts - Approx. 10% of Material Cost	1	LS	365,538	365,538
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4	TONS	17,500	70,552
129	L6x6x1/2 continuous angle	8	TONS	17,500	136,528
130	Drilling and bolting - 4 bolts at each connection	424	EA	216	91,584
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135					
136	OMIT				
137	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	(64)	EA	15,000	(960,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(62)	EA	10,500	(651,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
141	Fixed Panels including framing and support; 4'-6" High	(2,133)	SF	750	(1,599,750)
142	Spare Parts - Approx. 10% of Material Cost	(1)	LS	198,165	(198,165)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : FULTON STREET BWAY NASSAU

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
143	Platform Edge Reconstruction work	(1)	LS	476,360	(476,360)
144	Remove allowance for cast in sleeves for LV & HV power	(264)	EA	110	(29,040)
145	Conduit running under Platform Edge	(1,060)	LF	30	(31,800)
147	Allow loss of production to work at night say 50%	1	LS	815,514	815,514
148					
149					
150	PREMIUM ASSOCIATED WITH PSD's				3,533,893

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : BROAD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [BROOKLYN BOUND] =	532	LF		
5	LENGTH OF THE PLATFORM EDGE [QUEENS BOUND] =	532	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,064	LF		
7	NUMBER OF TRAIN CARS ON THIS LINE =	8	CARS		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,064	LF	7	7,448
14	Remove 5' wide section of 3" deep structural slab to platform edge	5,320	SF	12	63,840
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	107	CY	2,500	267,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,066	EA	25	26,650
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,066	EA	25	26,650
19	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
20	Polyethylene edge strip	1,064	LF	95	101,080
21	Provide sleeves for HV & LV wires	264	EA	110	29,040
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,064	LF	15	15,960
26	Remove existing platform tiles	1,064	LF	12	12,768
27	Sawcut existing topping concrete at perimeter of removal area	1,064	LF	5	5,320
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,384	SF	8	51,072
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,064	SF	15	15,960

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : BROAD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	384	LF	110	42,240
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	Equipment Room [6'-6" x 27'-6"]				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,645
39	CMU Wall for equipment room	405	SF	45	18,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	179	SF	30	5,363
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	405	SF	40	16,200
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,860
46	Concrete cove to match existing	41	LF	20	810
47	Interior Wall Finish - Paint	405	SF	5	2,025
48	Allow for Misc. floor & ceiling finishes	179	SF	15	2,681
49	Allow for 4" thick concrete pads for equipment	45	SF	20	894
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	Automatic Platform Gates [APGs] - 4'-6" High				
56	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	10,500	651,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,151	SF	750	1,613,250
61	Spare Parts - Approx. 10% of Material Cost	1	LS	198,975	198,975
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	64	EA	2,500	160,000
65					
66	Electrical				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : BROAD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,064	LF	60	63,840
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	350	LF	60	21,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	400	LF	60	24,000
76	Allowance for power to cross tracks to opposite platform	1	LS	15,000	15,000
77	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	Communications				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
97	Engineering and Testing	1,000	Hrs	160	159,930
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : BROAD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	3,356,963	3,356,963
114	TOTAL PSD WORK:				$ 14,546,839

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	15,000	930,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	4,606	SF	750	3,454,293
127	Spare Parts - Approx. 10% of Material Cost	1	LS	366,978	366,978
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	4	TONS	17,500	70,813
130	L6x6x1/2 continuous angle	8	TONS	17,500	137,043
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Platform Edge Repair				
133	Remove concrete platform edge				Previously done
134	Platform edge repair				Previously done
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
136					
137	OMIT				
138	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	(64)	EA	15,000	(960,000)
139	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	(62)	EA	10,500	(651,000)
140	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
141	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : BROAD STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Fixed Panels including framing and support; 4'-6" High	(2,151)	SF	750	(1,613,250)
143	Spare Parts - Approx. 10% of Material Cost	(1)	LS	198,975	(198,975)
144	Platform Edge Reconstruction work	(1)	LS	476,800	(476,800)
145	Remove allowance for cast in sleeves for LV & HV power	(264)	EA	110	(29,040)
146	Conduit running under Platform Edge	(1,064)	LF	30	(31,920)
147					
148	Allow loss of production to work at night say 50%	1	LS	817,881	817,881
149					
150	PREMIUM ASSOCIATED WITH PSD's				3,544,151

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : JAMAICA CTR. PARSONS / ARCHER

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE LOWER PLATFORM EDGE [NORTH BOUND] =	650	LF		
5	LENGTH OF THE LOWER PLATFORM EDGE [SOUTH BOUND] =	650	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,300	LF		
7	NUMBER OF TRAIN CARS ON THIS LINE =	8	CARS		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,300	LF	7	9,100
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,500	SF	12	78,000
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	131	CY	2,500	327,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,302	EA	25	32,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,302	EA	25	32,550
19	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
20	Polyethylene edge strip	1,300	LF	95	123,500
21	Provide sleeves for HV & LV wires	264	EA	110	29,040
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,300	LF	15	19,500
26	Remove existing platform tiles	1,300	LF	12	15,600
27	Sawcut existing topping concrete at perimeter of removal area	1,300	LF	5	6,500
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,800	SF	8	62,400
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	780	SF	8	6,240
30	New Work				
31	New concrete topping to match existing	1,300	SF	15	19,500

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : JAMAICA CTR. PARSONS / ARCHER

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	780	SF	15	11,700
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	384	LF	110	42,240
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	Equipment Room [6'-6" x 27'-6"]				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,645
39	CMU Wall for equipment room	405	SF	45	18,225
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	179	SF	30	5,363
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	405	SF	40	16,200
45	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,860
46	Concrete cove to match existing	41	LF	20	810
47	Interior Wall Finish - Paint	405	SF	5	2,025
48	Allow for Misc. floor & ceiling finishes	179	SF	15	2,681
49	Allow for 4" thick concrete pads for equipment	45	SF	20	894
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	Automatic Platform Gates [APGs] - 4'-6" High				
56	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	10,500	651,000
58	Double egress/service gate in the center of the platform; #1 per Platform	4	EA	20,000	80,000
59	Platform End Gates (PEGs)	8	EA	13,000	104,000
60	Fixed Panels including framing and support; 4'-6" High	3,141	SF	750	2,355,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	249,045	249,045
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	64	EA	2,500	160,000
65					
66	Electrical				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : JAMAICA CTR. PARSONS / ARCHER

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,300	LF	60	78,000
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	800	LF	60	48,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	850	LF	60	51,000
76	Allowance for power to cross tracks to opposite platform [Lower Level]	1	LS	35,000	35,000
77	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	Communications				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
97	Engineering and Testing	1,000	Hrs	160	159,930
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : JAMAICA CTR. PARSONS / ARCHER

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	3,690,256	3,690,256
114	TOTAL PSD WORK:				$ 15,991,110

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	15,000	930,000
124	Double egress/service gate in the center of the platform; #1 per Platform	4	EA	30,000	120,000
125	Platform End Gates (PEGs)	8	EA	18,000	144,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	6,387	SF	750	4,790,301
127	Spare Parts - Approx. 10% of Material Cost	1	LS	455,058	455,058
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	86,230
130	L6x6x1/2 continuous angle	10	TONS	17,500	167,440
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Platform Edge Repair				
133	Remove concrete platform edge	1,300	LF	27	35,100
134	Platform edge repair	1,300	LF	109	141,700
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	544	EA	10	5,440
136					
137	OMIT				
138	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	(64)	EA	15,000	(960,000)
139	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	(62)	EA	10,500	(651,000)
140	Double egress/service gate in the center of the platform; #1 per Platform	(4)	EA	20,000	(80,000)
141	Platform End Gates (PEGs)	(8)	EA	13,000	(104,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : JAMAICA CTR. PARSONS / ARCHER

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Fixed Panels including framing and support; 4'-6" High	(3,141)	SF	750	(2,355,750)
143	Spare Parts - Approx. 10% of Material Cost	(1)	LS	249,045	(249,045)
144	Platform Edge Reconstruction work	(1)	LS	562,760	(562,760)
145	Remove allowance for cast in sleeves for LV & HV power	(264)	EA	110	(29,040)
146	Conduit running under Platform Edge	(1,300)	LF	30	(39,000)
147					
148	Allow loss of production to work at night say 50%	1	LS	1,059,841	1,059,841
149					
150	**PREMIUM ASSOCIATED WITH PSD's**				**4,592,643**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : SUTPHIN BLVD ARCHER AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE LOWER PLATFORM EDGE [SOUTH BOUND] =	650	LF		
5	LENGTH OF THE LOWER PLATFORM EDGE [NORTH BOUND] =	650	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,300	LF		
7	NUMBER OF TRAIN CARS ON THIS LINE =	8	CARS		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,300	LF	7	9,100
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,500	SF	12	78,000
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	131	CY	2,500	327,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,302	EA	25	32,550
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,302	EA	25	32,550
19	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
20	Polyethylene edge strip	1,300	LF	95	123,500
21	Provide sleeves for HV & LV wires	264	EA	110	29,040
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,300	LF	15	19,500
26	Remove existing platform tiles	1,300	LF	12	15,600
27	Sawcut existing topping concrete at perimeter of removal area	1,300	LF	5	6,500
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,800	SF	8	62,400
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	528	SF	8	4,224
30	New Work				
31	New concrete topping to match existing	1,300	SF	15	19,500

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : SUTPHIN BLVD ARCHER AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	528	SF	15	7,920
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	384	LF	110	42,240
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [6'-6" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	62	LF	90	5,535
39	CMU Wall for equipment room	615	SF	45	27,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	179	SF	30	5,363
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	615	SF	40	24,600
45	Mosaic Band to match existing - Assuming 8" high	62	LF	120	7,380
46	Concrete cove to match existing	62	LF	20	1,230
47	Interior Wall Finish - Paint	615	SF	5	3,075
48	Allow for Misc. floor & ceiling finishes	179	SF	15	2,681
49	Allow for 4" thick concrete pads for equipment	45	SF	20	894
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	10,500	651,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	3,213	SF	750	2,409,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	246,765	246,765
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	64	EA	2,500	160,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : SUTPHIN BLVD ARCHER AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,300	LF	60	78,000
	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	900	LF	60	54,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	950	LF	60	57,000
76	Allowance for power to cross tracks to opposite platform; 4 Tracks between Platforms	1	LS	35,000	35,000
77	No allowance for new lighting as if APG's are used		Note		EXCL.
78	Grounding				
79	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
80	MISC				
81	Testing and commissioning	1	EA	30,000	30,000
82	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
83					
84	Communications				
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
97	Engineering and Testing	1,000	Hrs	160	159,930
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : SUTPHIN BLVD ARCHER AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	3,687,152	3,687,152
114	TOTAL PSD WORK:				$ 15,977,660

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	62	EA	15,000	930,000
124	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
125	Platform End Gates (PEGs)	4	EA	18,000	72,000
126	Fixed Panels including framing and support; Assuming 8'-0" high	6,494	SF	750	4,870,293
127	Spare Parts - Approx. 10% of Material Cost	1	LS	451,938	451,938
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	5	TONS	17,500	86,230
130	L6x6x1/2 continuous angle	10	TONS	17,500	167,440
131	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
132	Platform Edge Repair				
133	Remove concrete platform edge	1,300	LF	27	35,100
134	Platform edge repair	1,300	LF	109	141,700
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	528	EA	10	5,280
136					
137	OMIT				
138	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	(64)	EA	15,000	(960,000)
139	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #31 per Platform	(62)	EA	10,500	(651,000)
140	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
141	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for J,Z - Line Stations

15-Oct-18

STATION : SUTPHIN BLVD ARCHER AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
142	Fixed Panels including framing and support; 4'-6" High	(3,213)	SF	750	(2,409,750)
143	Spare Parts - Approx. 10% of Material Cost	(1)	LS	246,765	(246,765)
144	Platform Edge Reconstruction work	(1)	LS	562,760	(562,760)
145	Remove allowance for cast in sleeves for LV & HV power	(264)	EA	110	(29,040)
146	Conduit running under Platform Edge	(1,300)	LF	30	(39,000)
147					
148	Allow loss of production to work at night say 50%	1	LS	1,055,338	1,055,338
149					
150	PREMIUM ASSOCIATED WITH PSD's				4,573,132

New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR 'L' (CANARSIE) LINE STATIONS

CONTRACT #: C-32514 | STV PROJECT #: 3017214

FINAL SUBMITTAL DATE: JULY 9, 2018

STV 100 Years

Table of Contents

Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C
- A study of the four Manhattan stations of the Canarsie L-line performed in 2017 in an effort to identify a station to serve as a pilot for the PSD program: Appendix D.

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations.

The Tier 1 analysis of door arrangement in the vehicles dedicated to this line found that there are no problems of incompatibility; one train car type (R143 and R160- dimensionally identical) and one train consist will be run on the Canarsie line for the foreseeable future (the assumed design year for this study is between 2018 and 2032). In addition, this is the first line in the NYCT system to receive computer based train control (CBTC) enabling the stop location of the trains to be consistent. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

There are a total of 24 stations included in this study. Four of them were studied previously to identify the location for the Pilot PSD installation. Of the remaining 19 stations in Brooklyn and 1 in Manhattan, 12 are underground stations, 5 are elevated stations, 2 are at-grade and one is mixed with one subway track and one track at-grade. The stations are a mix of center/island and side platforms thus this report gives a good sense of the variety of issues we are likely to encounter as we complete our study in the rest of the NYCT system.

Of these 20 newly evaluated stations, ten have been found to be not suitable for the installation of PSDs. The reasons for this finding vary but are generally related to space constraints and existing structure.

[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems]

The following summarizes the major findings:

- ADA clearance issues; the platform edge barriers are 15" thick. Where an existing object (wall, stair, railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Where these PSDs hamper the ability of a wheelchair to turn (a 5'-0" circle), it is declared infeasible.
- Insufficient space for the PSD equipment room; the equipment room can be built as one long room (7'-6" x 30') or two smaller rooms (7'-6" x 16'). Many stations do not have available space for these rooms.
- Platforms that are too narrow; due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements in regard to the placement of these new barriers in an existing station environment.
- Structural considerations; existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis within the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.

- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the wall and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

The table on the following page summarizes these findings, and shows that platform edge barriers are feasible at 58% of the "L" (Canarsie) Line stations. Total implementation cost would be $384.2M for APGs and $487.8M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; That estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of $931,000 for the first three years of maintenance, (see Appendix F) therefore for the 14 feasible stations, the aggregate annual maintenance cost would be $13,034,000.

'L' (Canarsie) Line Summary of Feasibility (58% feasible; 14/ 24)

No.	Station Name	Station Type	Platform Type	Feasible Yes / No	Issues / Reason for Failure	Cost APGs	Cost PSDs
MR-115	8th Ave	Subway	Center/Island	Yes		$27.9M	$35.0M
MR-116	6th Ave*	Subway	Center/Island	No	• ADA clearance		
MR-117	14th Street - Union Square*	Subway	Center/Island	No	• ADA clearance		
MR-118	3rd Ave*	Subway	Side	Yes		$23.4M	$31.4M
MR-119	1st Ave*	Subway	Side	Yes		$22.7M	$30.7M
MR-120	Bedford Ave	Subway	Center/Island	No	• No space for equipment room		
MR-121	Lorimer Street	Subway	Side	No	• No space for equipment room		
MR-122	Graham Avenue	Subway	Side	Yes		$28.7M	$36.1M
MR-123	Grand Street	Subway	Side	Yes		$28.7M	$36.1M
MR-124	Montrose Ave	Subway	Side	Yes		$28.0M	$35.4M
MR-125	Morgan Ave	Subway	Side	Yes		$27.9M	$35.3M
MR-126	Jefferson Street	Subway	Side	Yes		$28.0M	$35.4M
MR-127	Dekalb Ave	Subway	Side	Yes		$28.0M	$35.4M
MR-128	Myrtle-Wyckoff Ave	Subway	Center/Island	Yes		$27.9M	$35.3M
MR-129	Halsey Street	Subway	Side	Yes		$27.9M	$35.3M
MR-130	Wilson Ave	1 Trk - At-grade 1 Trk - Subway	Side	Yes		$28.6M	$35.7M
MR-131	Bushwick Ave-Aberdeen Street	Subway	Side	Yes		$28.6M	$35.4M
MR-132	Broadway Junction	Elevated	Side and Center	Yes	• APGs are feasible • PSDs not feasible due to open platform	$27.9M	$35.3M
MR-133	Atlantic Ave	Elevated	Center/Island	No	• ADA clearance		
MR-134	Sutter Ave	Elevated	Side	No	• Precast platform (Appendix B)		
MR-135	Livonia Ave	Elevated	Side	No	• Precast platform (Appendix B) • Stair too close to platform edge		
MR-136	New Lots Ave	Elevated	Side	No	• Egress precluded by platform width • Stair too close to platform edge		
MR-137	East 105th Street	At-grade	Center/Island	No	• Precast platform (Appendix B)		
MR-138	Rockaway Parkway	At-grade	Center/Island	No	• Egress precluded by platform width		
					Total Estimated Cost	$384.2M	$487.8M

*See previous report for Manhattan Stations (Appendix D)

1.0 Station Assessments

1.1 Bedford Avenue Station

Summary: *Bedford Avenue Station (MR-120) is not feasible for both APGs and PSDs as there is not enough area to adequately locate a PSD equipment room(s). Possible equipment room locations on the platform are precluded by minimal platform length beyond the trains' stopping locations and the end of the platform. Additionally, the mezzanines are compact and fully occupied by back-of-house elements and circulation space. If a platform edge barrier (15") and an equipment room (7'-6" wide) were installed along the platform, ADA minimum clearances of 32" would not be met (see figure 1).*

Description:

The Bedford Avenue station is a below-grade station, which has a 20'-wide center/island platform configuration with a cast-in-place concrete platform structure. As part of the Canarsie Tunnel reconstruction project, the planned work at Bedford Avenue Station will renovate the existing station. As part of the planned work, an elevator is being installed. Existing stair replacement as well as additional staircases are also a part of the planned station work. The planned work will also reconfigure portions of the far ends of the platform to optimize space utilization for maintainer and operations areas. The platform will retain its straight geometry with two rows of columns symmetrically placed approximately 15 feet apart on center and 3'-6" from face of columns to the platform edge.

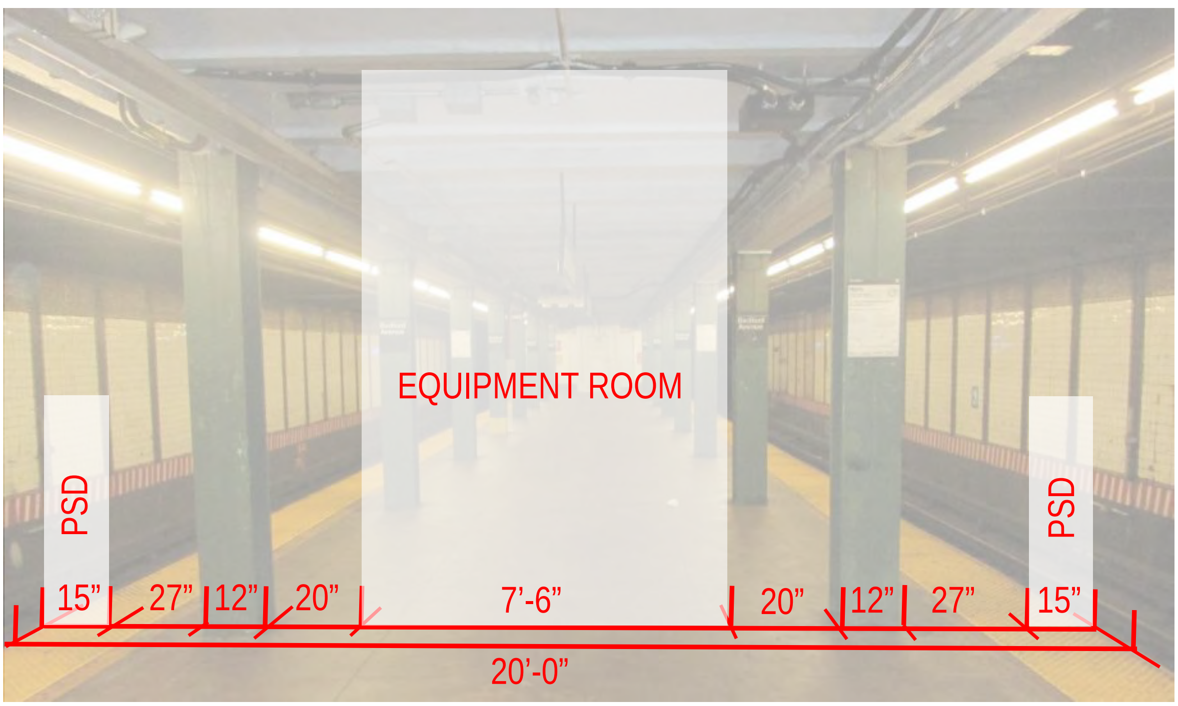

Figure 1 – Platform width analysis, ADA clearance (32") not met– Bedford Avenue Station

1.2 Lorimer Street Station

Summary: Lorimer Street Station (MR-121) is not feasible for APGs or PSDs as there is not enough area to adequately locate PSD equipment room(s). Neither the mezzanine, nor the platforms offer adequate area to accommodate an equipment room. The plan diagram below demonstrates the infeasibility of an equipment room at the end of the platform due to ADA non-compliance at the first door of the train and the infringement on circulation at this end of the station.

Description:
The Lorimer Street Station is a below-grade station consisting of two (2) side platforms with columns at approximately 15 feet on center along the length of the platforms. The platforms have a slightly curved geometry with a single line of columns with a varying offset from the platform edge. At the east-end of the platform (on both tracks) there are existing mechanical rooms and very limited space before the end-of-train position. Connections to other lines are available at the west-end of the station. These areas are highly trafficked in addition to not having adequate area to accommodate an equipment room. As illustrated in figure 1 below, circulation space would be severely reduced in a highly trafficked area.

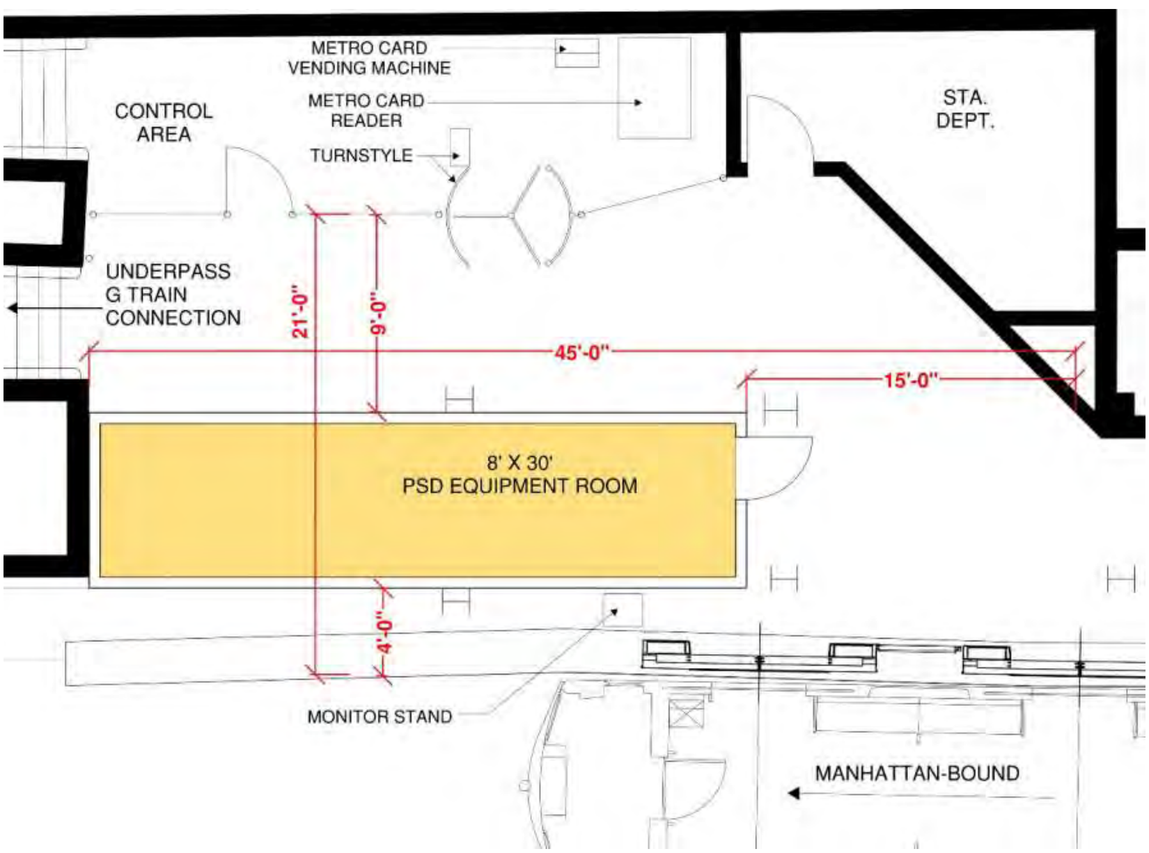

Figure 1– Potential location for equipment room would impede on circulation space- Lorimer Street Station

1.3 Graham Avenue Station

Summary: Graham Avenue Station (MR-122) is feasible for both APGs and PSDs. As there are no columns along the length of the station, there are no ADA obstructions. However, there are various lighting fixtures and conduits above the platform edge and conduit below the platform edge that would need to be coordinated in the installation of a platform edge barrier. Platform structural work will be required to support the added load of the platform edge barrier (see structural report; Appendix B). Existing power is adequate.

Description

Graham Avenue Station is a below-grade station with straight side platforms. The platform structure is made of cast-in-place concrete. Platforms are accessed at the center. Back-of-house rooms are located at either end of the platforms. The length of the platforms are column free. Both platforms are approximately 9'-10" wide. Above both platform edges are multiple beam-mounted conduits (approx. 5 above each edge). See figure 1 for an overall station plan and figure 3 for a typical platform view.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs): This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Wall-mounted conduit below the platform edge would need to be coordinated to accommodate the requirements of the APG system.

Equipment Room

Two equipment rooms would be required; both rooms can be located at the east end on each platform. Both PSD equipment rooms would be approximately 7'-0" x 17'-0" (see figure 2).

Track Layout

Track is tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

Existing conditions: Platform edge appears to be original to station construction, and will therefore require reconstruction to support new platform APGs or PSDs. The 2012 NYCT condition survey report gave the platform edges a rating of 3.5.

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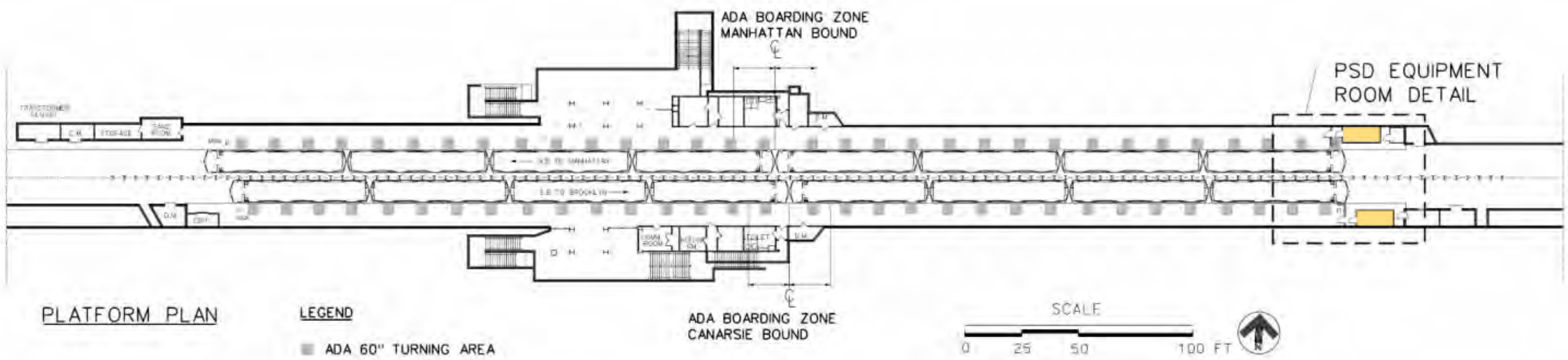

Figure 1 - Station Plan – Graham Avenue Station

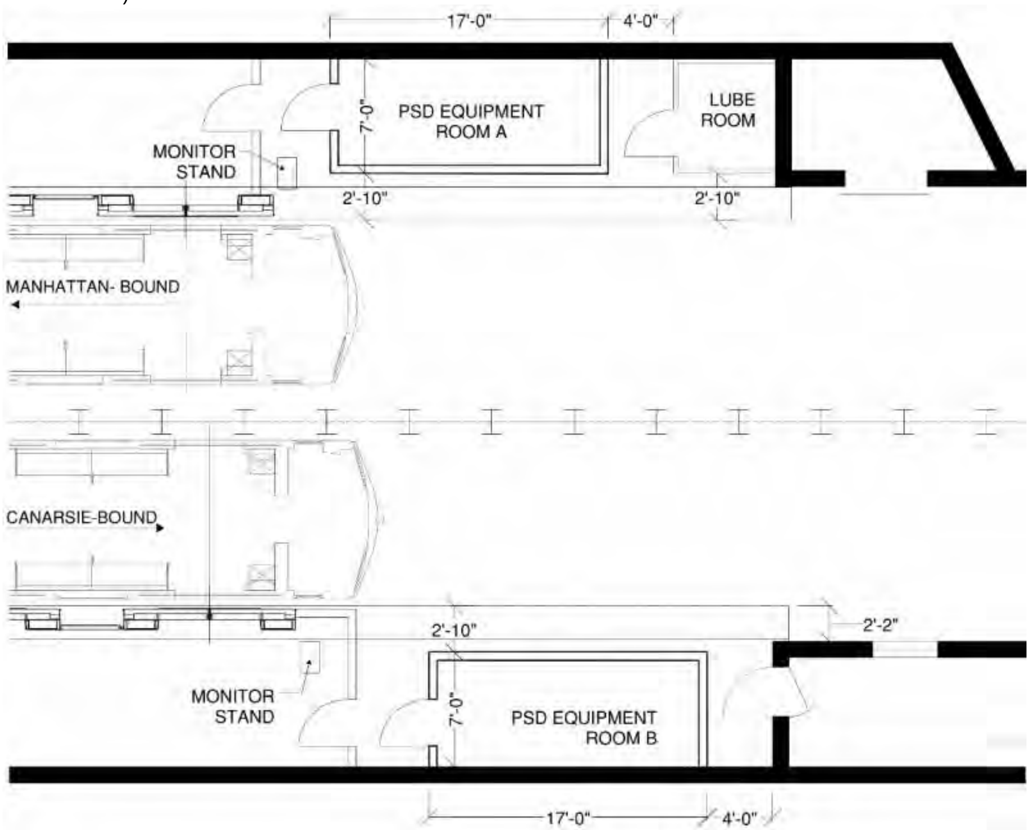

Figure 2 – Enlarged PSD Equipment Room(s) Detail- Graham Avenue Station

Platform obstructions within 5' of edge:

Canarsie-bound: There are no obstructions.

Manhattan-bound: There are no obstructions.

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

Power is adequate. See Electrical table below. Calculation is based on APG loads which are the most demanding.

Canarsie Line Station Electrical Capacity Analysis	
NYC T Station MR Number	122
Station Name	Graham Avenue
Peak Demand Load from ConEd Report, Last 20 Months,(kW)	43.8
Peak Demand Load, Max Current (A)	152.0
PSD Total Load for N Doors, including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	317.0
Station Service Power Capacity, (A)	400.0
Service Spare Capacity, (A)	83.0
Electrical Service is Adequate or Not	Yes

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $28.7M to install APGs $36.1 to install PSDs (see Appendix E).

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn
(Graham Avenue Station)

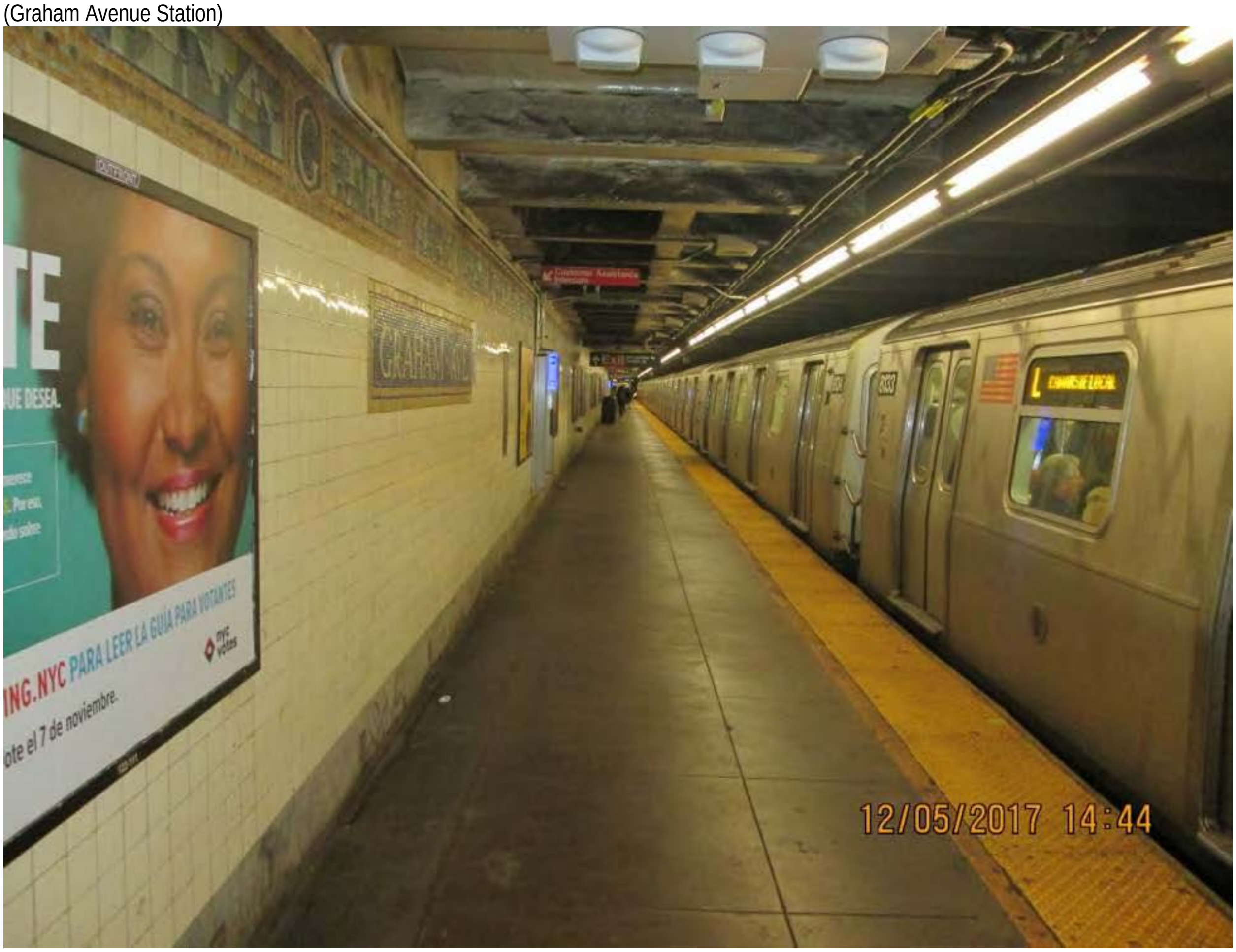

Figure 3 –Typical Platform Condition- Graham Avenue Station

1.4 Grand Street Station

Summary: *Grand Street Station (MR-123) is feasible for both APGs and PSDs. As there are no columns along the length of the station, there are no ADA obstructions. However, there are various lighting fixtures and conduits above the platform edge and conduit below the platform edge that would need to be coordinated in the installation of a platform edge barrier. Platform structural work will be required to support the added load of the platform edge barrier (see structural report; Appendix B). Existing power is adequate.*

Description

Grand Street Station is a below-grade station with column free side platforms that are curved. The platform structure is made of cast-in-place concrete. The platforms are accessed at the center. Back-of-house elements are at either end of the platforms as well as adjacent to the central entry areas. The Manhattan-bound platform is approximately 10"-0" wide while the Canarsie-bound platform is 9'-10" wide. There are 4 beam mounted conduits above the platform edge on the Canarsie-bound platform and seven beam mounted conduits above the platform edge on the Manhattan-bound platform. See figure 1 for an overall station plan and figure 3 for a typical platform view.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs): This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Wall-mounted conduit below the platform edge would need to be coordinated to accommodate the requirements of the APG system

Equipment Room

Two equipment rooms would be required, both rooms can be located at the north end on each platform. Both platforms would house PSD equipment rooms approximately 7'-0" x 17'-0" (see figure 2).

Track Layout

Track is mildly. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

Existing conditions: Platform edge appears to be original to station construction, and will therefore require reconstruction to support new platform APGs or PSDs. The 2012 NYCT condition survey report gave the platform edges a rating of 3.

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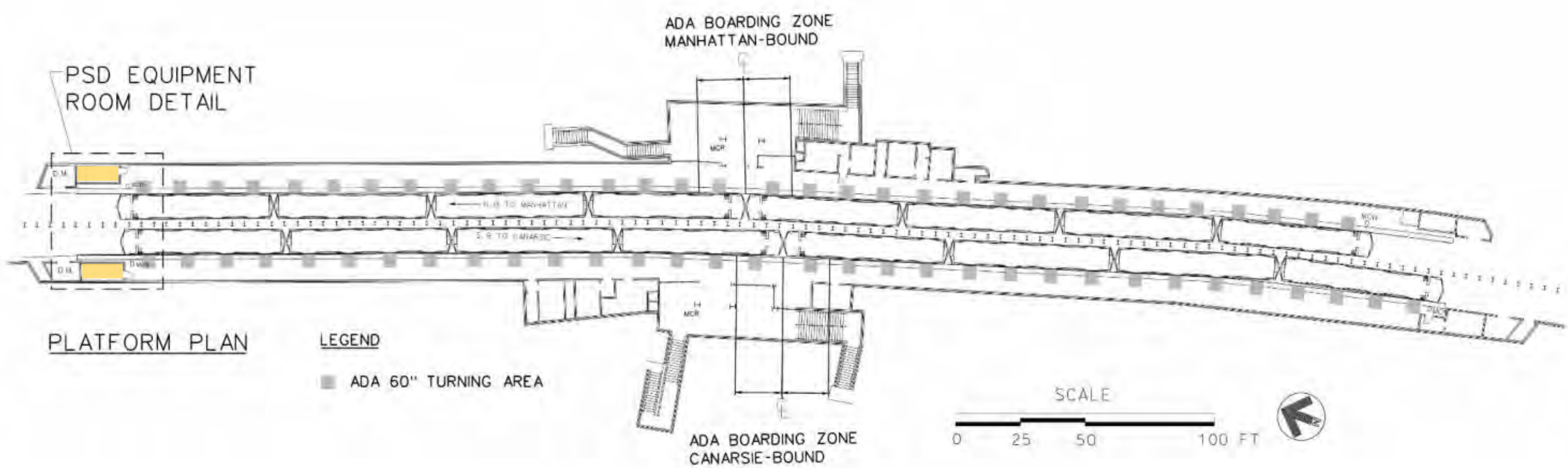

Figure 1 – Station Plan - Grand Street Station

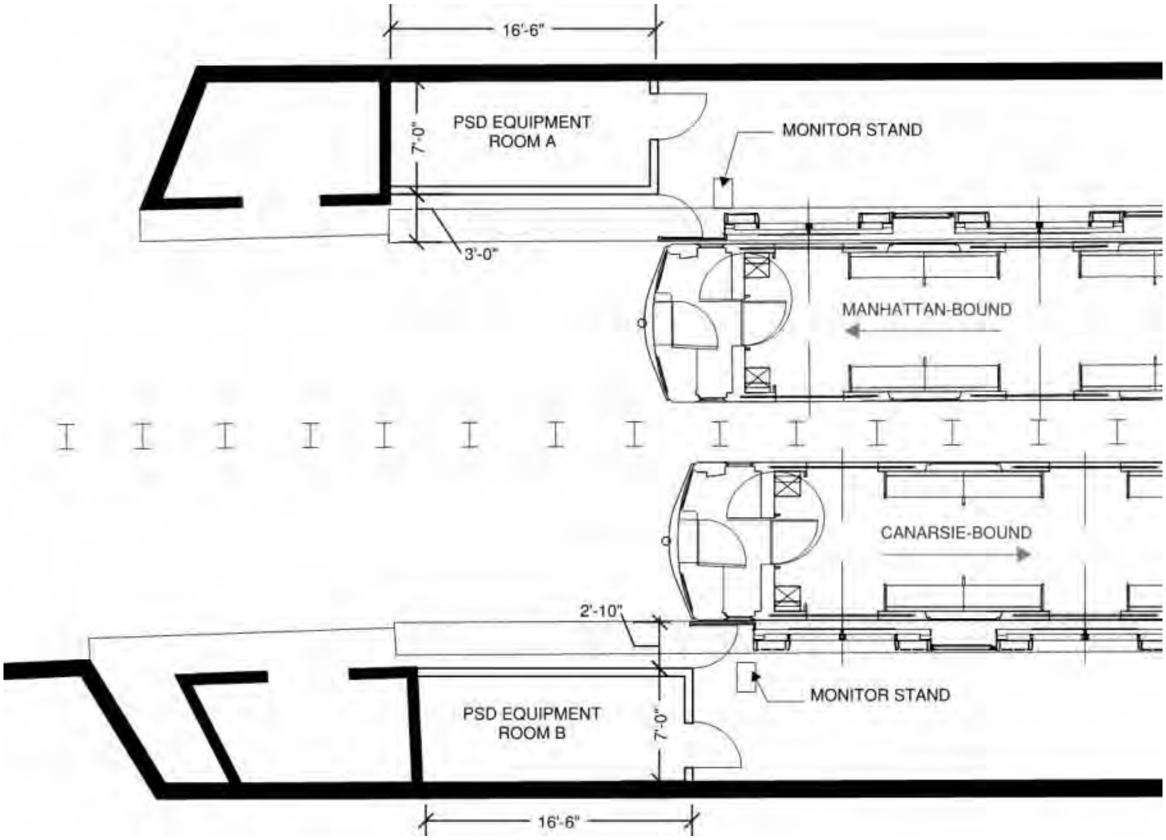

Figure 2 – Enlarged PSD Equipment Room Detail- Grand Avenue Station

Platform obstructions within 5' of edge:

Canarsie-bound: There are no obstructions.

Manhattan-bound: There are no obstructions.

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

Power is adequate. See Electrical table below. Calculation is based on APG loads which are the most demanding.

Canarsie Line Station Electrical Capacity Analysis	
NYC T Station MR Number	123
Station Name	Grand St
Peak Demand Load from ConEd Report, Last 20 Months,(kW)	34.8
Peak Demand Load, Max Current (A)	120.7
PSD Total Load for N Doors, including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	285.7
Station Service Power Capacity, (A)	400.0
Service Spare Capacity, (A)	114.3
Electrical Service is Adequate or Not	Yes

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $28.7M to install APGs and $36.1M to install PSDs (See Appendix E).

Figure 3 – Typical Platform Condition- Grand Avenue Station

1.5 Montrose Avenue Station

Summary: *Montrose Avenue Station (MR-124) is feasible for both APGs and PSDs. There is an existing column in front of an ADA door on the Canarsie-bound platform which is currently not compliant; this condition would not be exacerbated by the implementation of a platform edge barrier. Platform structural work will be required to support the added load of the platform edge barrier (see structural report; Appendix B). Existing power is adequate.*

Description

Montrose Avenue is a below-grade station with side platforms. Both the Manhattan-bound and Canarsie-bound cast-in-place concrete platforms are accessed via a mezzanine at the center of the platform. The platforms are straight with columns located approximately 15' on center. The platforms are 11'-10" wide and column faces are located 42" away from the platform edge. There are minimal back-of-house areas in this station, and they are located at the ends of both platforms. This station is unique in that there are various ceiling heights and column conditions along the platform edge. In some parts of the station, there are angled braces above the platform edge. Ceiling heights at the platform edge vary from 9'-2" to 16'-1". There is minimal conduit above the platform edge. See figure 1 for an overall station plan and figure 4 for a typical platform view.

Full Height PSDs*:* Due to the varying conditions above the platform edge, there would not be a uniform solution for the length of the platform. Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDS (aka APGs): This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Conduit hung below the platform edge would need to be coordinated to accommodate the requirements of the APG system.

Equipment Room

Two equipment rooms are needed, there is space to accommodate these rooms at the north end of the Canarsie-bound platform and the south end of the Manhattan-bound platform. The room dimensions are approximately 17'-0" x 7'-0" (see figures 2 and 3).

Track Layout

Track is tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

Existing conditions: Platform edge appears to be original to station construction, and will therefore require reconstruction to support new platform APGs or PSDs. The 2012 NYCT condition survey report gave the platform edges a rating of 4.

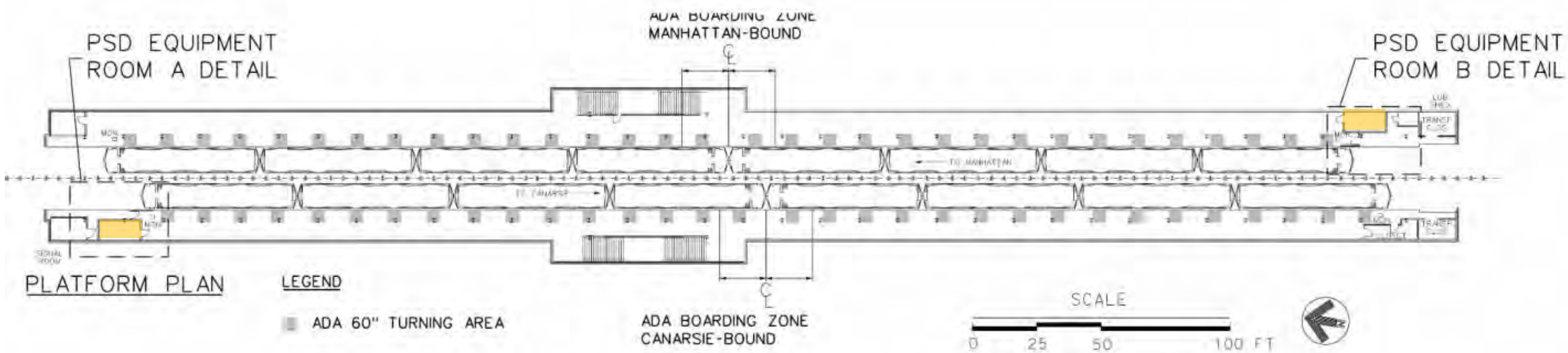

Figure 1– Station Plan – Montrose Avenue Station

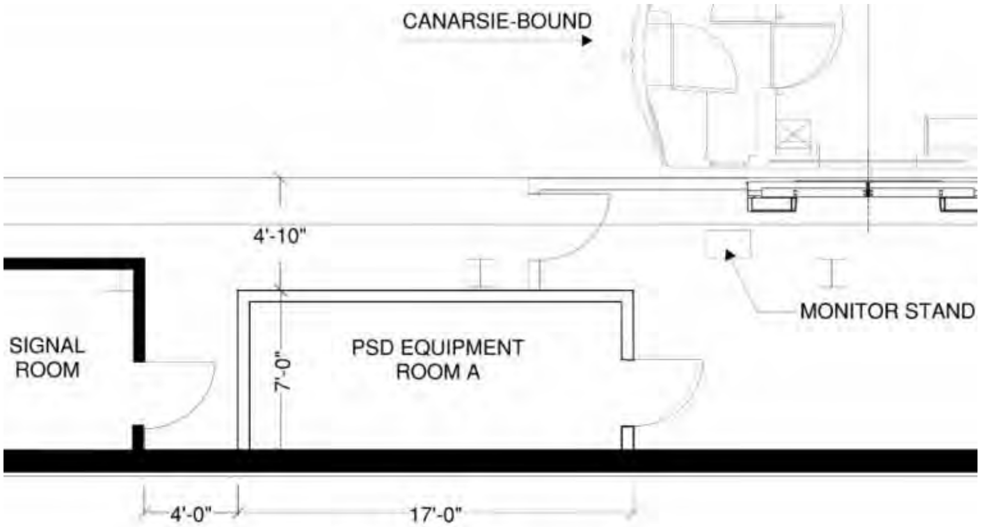

Figure 2 – PSD Equipment Room A Detail- Montrose Avenue Station

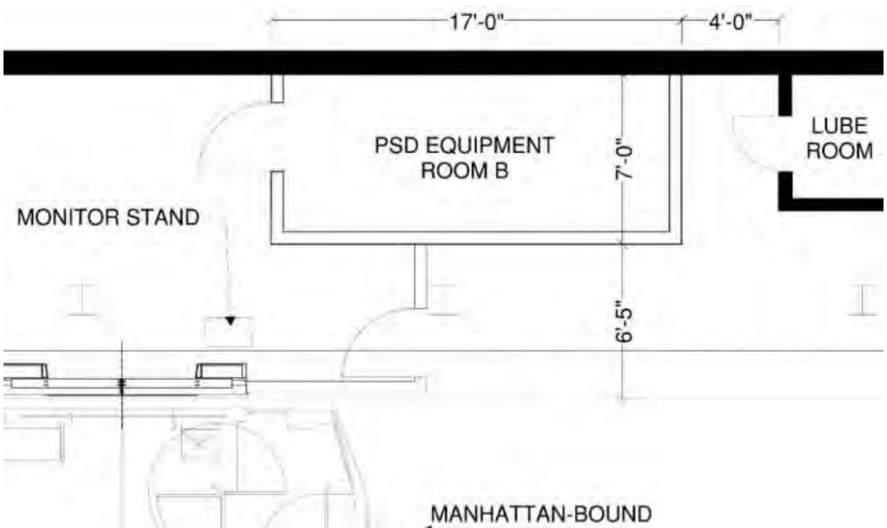

Figure 3 – PSD Equipment Room B Detail- Montrose Avenue Station

Platform obstructions within 5' of edge:

Canarsie-bound: All columns are 42" from platform edge. One column is in front of an ADA - designated door, however the implementation of a platform edge barrier would not exacerbate this already non-compliant condition.

Manhattan-bound: All columns are 42" from platform edge. One column is in front of an ADA - designated door, however, the critical ADA dimensions are met.

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

Power is adequate. See Electrical table below. Calculation is based on APG loads which are the most demanding.

Canarsie Line Station Electrical Capacity Analysis	
NYC T Station MR Number	124
Station Name	Montrose Avenue
Peak Demand Load from ConEd Report, Last 20 Months,(kW)	37.2
Peak Demand Load, Max Current (A)	129.1
PSD Total Load for N Doors, including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	294.1
Station Service Power Capacity, (A)	400.0
Service Spare Capacity, (A)	105.9
Electrical Service is Adequate or Not	Yes

Historic Restrictions:

None

Rough order-of-magnitude cost estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $28.0M to install APGs $35.4M to install PSDs (See Appendix E).

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Figure 4 – Platform edge condition- Montrose Avenue Station

1.6 Morgan Avenue Station

Summary: *Morgan Avenue Station (MR-125) is feasible for APGS or PSDs. On the Manhattan-bound side, the existing position of the ADA door is in front of a column, but the 32" horizontal clearance is met. On the Canarsie-bound platform, there is a 4" wide fire standpipe which runs the length of the platform, with an arm extending beyond the platform edge. The implementation of PSDs would require rerouting of the standpipe. Platform structural work will be required to support the added load of the platform edge barrier (see structural report; Appendix B). Existing power is adequate.*

Description:

The Morgan Avenue Station is a below-grade, side platform station with columns approximately 15 feet on center along the length of the platform. The platform structure is cast-in-place concrete. Stair access is available at the west end of the platform. Ramped walkway access is located at the east end of the station. The columns at this station are larger due to their tile surround. On the Manhattan-bound platform, the majority of columns are at 3 feet from the platform edge in the area that the train stops. On the Canarsie-bound platform, the face of the columns range from 36 to 39 inches from the edge of the platform. Both platforms are approximately 12' wide. There is a condition on the Canarsie-Bound platform in which a 4" fire standpipe runs along the length of the platform with an arm that extends beyond the platform edge at an elevation of 8 feet above the platform. On the Manhattan-bound platform, there are six conduits mounted above the platform edge. On the Canarsie-bound platform there are three conduits above the platform edge, and signage mounted 2'-2" from the edge of the platform. See figure 1 for an overall station plan and figure 3 for a typical platform view.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. In this case, there would also be the need to reroute the fire standpipe which extends over the platform edge (see figure 4)

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Wall-mounted conduit below the platform edge would need to be coordinated to accommodate the requirements of the APG system

Equipment Room

Space required for equipment room is available at the west end of the Canarsie-bound platform (rough/approximate size of 8' x 30'). See figure 2.

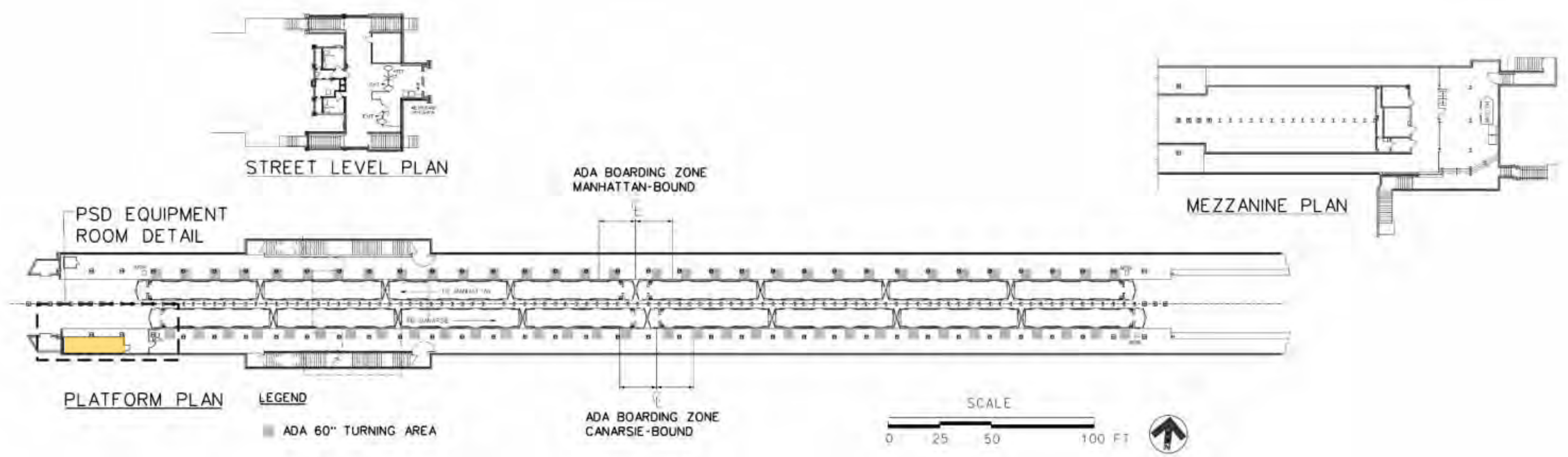

Figure 1– Station Plan – Morgan Avenue Station

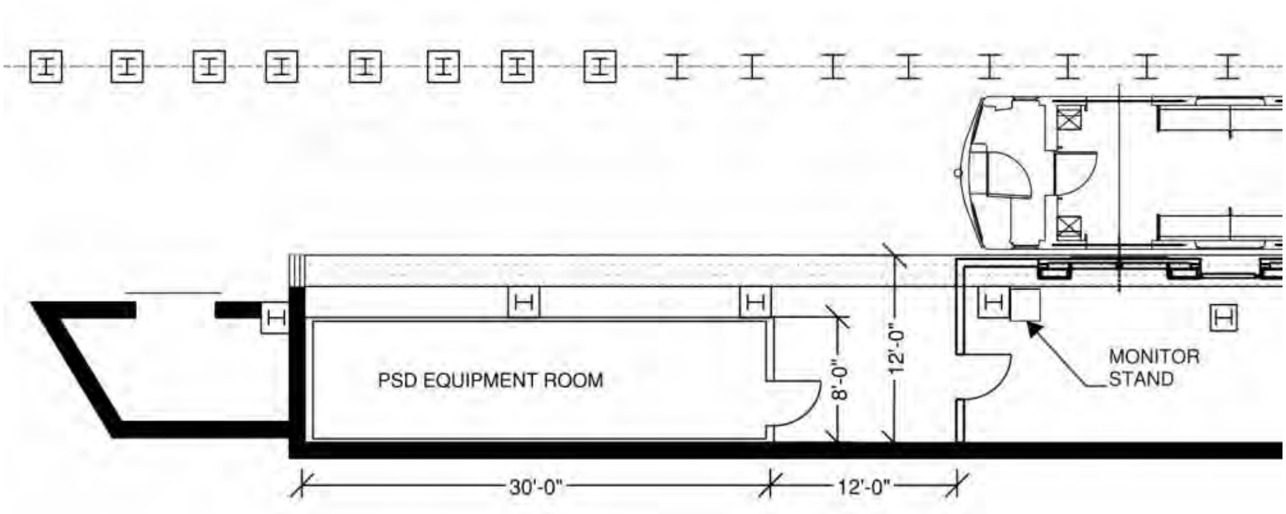

Figure 2 –Enlarged PSD Equipment Room Detail– Morgan Avenue Station

Track Layout

Track is tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

Existing conditions: Platform edge appears to be original to station construction, and will therefore require reconstruction to support new platform APGs or PSDs. The 2012 NYCT condition survey report gave the platform edges a rating of 3.5.

Platform obstructions within 5' of edge:

Canarsie-bound: Columns range from 36 to 39 inches from the platform edge. There are no other obstructions.

Manhattan-bound: The majority of columns are 3 feet from the platform edge in the area that the train stops. One column is located in front of an ADA - designated door; however, the condition is not exacerbated by the implementation of a platform edge barrier. It is not anticipated that the installation of platform barriers would further impede these existing issues at non ADA-designated doors.

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

Power is adequate. See Electrical table below. Calculation is based on APG loads which are the most demanding.

Canarsie Line Station Electrical Capacity Analysis	
NYCT Station MR Number	125
Station Name	Morgan Ave
Peak Demand Load from ConEd Report, Last 20 Months,(kW)	40.2
Peak Demand Load, Max Current (A)	139.5
PSD Total Load for N Doors, including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	304.5
Station Service Power Capacity, (A)	400.0
Service Spare Capacity, (A)	95.5
Electrical Service is Adequate or Not	Yes

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.9M to install APGs and $35.3M to install PSDs (See Appendix E).

Figure 3– Typical Platform View – Morgan Avenue Station

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Figure 4 – Canarsie-bound Platform Standpipe Extending Beyond Platform Edge- Morgan Avenue Station

1.7 Jefferson Street Station

Summary: Jefferson Street Station (MR-126) is feasible for both APGs and PSDs. The implementation of PSDs would require rerouting of a standpipe over the Manhattan-bound platform. On the Canarsie-bound platform, there is a column located in front of an ADA-designated door. The current non-complying condition would not exacerbated by the implementation of a platform edge barrier. Platform structural work will be required to support the added load of the platform edge barrier (see structural report; Appendix B). Existing power is adequate.

Description

Jefferson Street Station is a below-grade station with straight side platforms. Access is available at both ends of the platform. The platform structure is cast-in-place concrete. The ends of the platforms widen to accommodate stairs and back-of house-elements. Both platforms are approximately 12' wide with columns spaced approximately 15' on center. On both platforms, the faces of the columns are approximately 3'-4" from the platform edge. There is a mezzanine level above the east end of the platform accessed at the intersection of Wyckoff Avenue and Starr Street. On the Manhattan-bound platform, a fire standpipe extends beyond the platform edge with a clearance of 7'-1" to the bottom of the pipe (see figure 4). There is also significant amount of ceiling-mounted conduit at the platform edges. See figure 1 for an overall station plan and figure 3 for a typical platform view.

Full Height PSDs: As noted in the executive summary, PSDs would require the rerouting of a standpipe. Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs): This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Existing wall-mounted conduit below the platform edge would need to be coordinated to accommodate the requirements of the APG system.

Equipment Room

One room can be located behind the attendant booth at the mezzanine level at the Starr Street and Wyckoff Avenue intersection. There is only 7'-5" behind the booth, but the length of the equipment room can exceed 30 feet. The proposed room dimension is 7'-0" x 35'-0" (see figure 2).

Track Layout

Track is tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

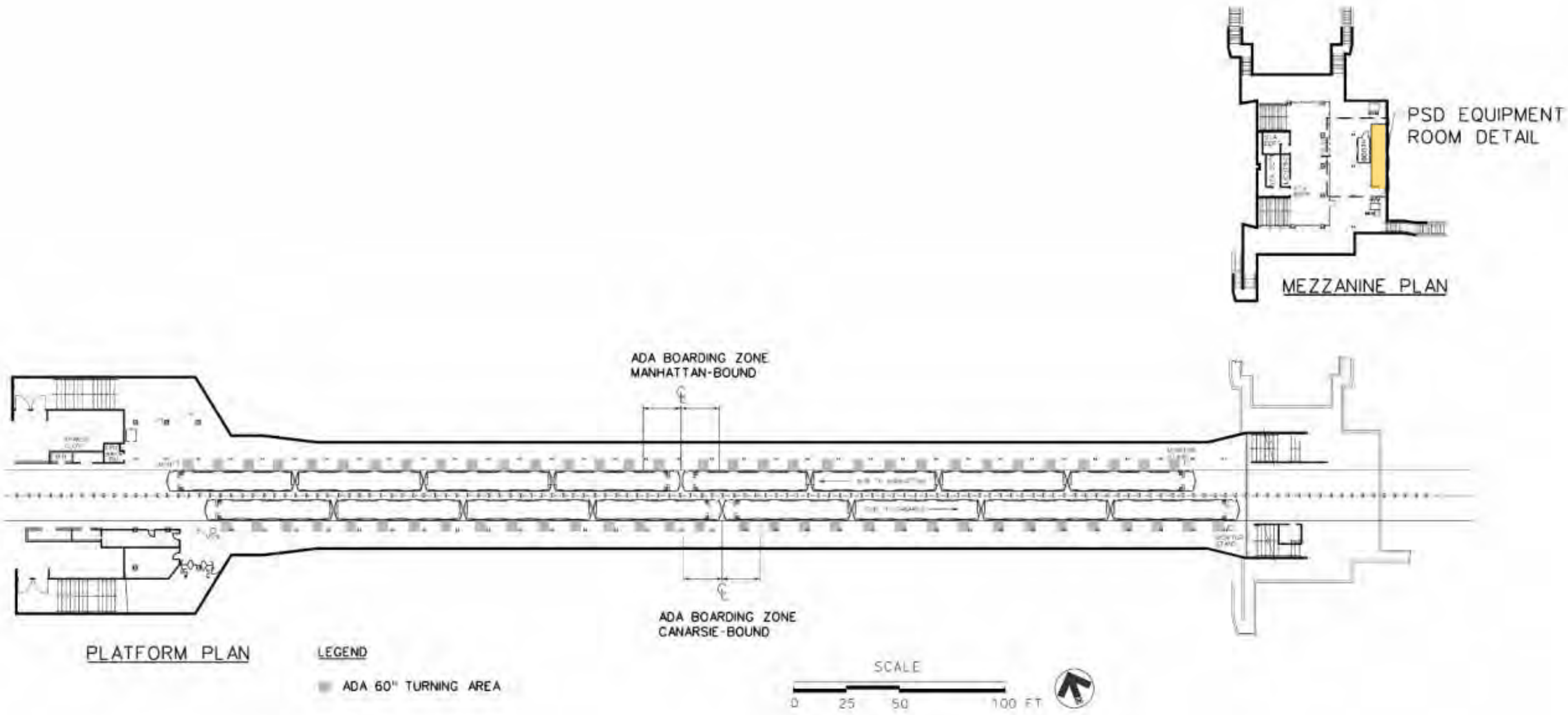

Figure 1 - Station Plan - Jefferson St Station

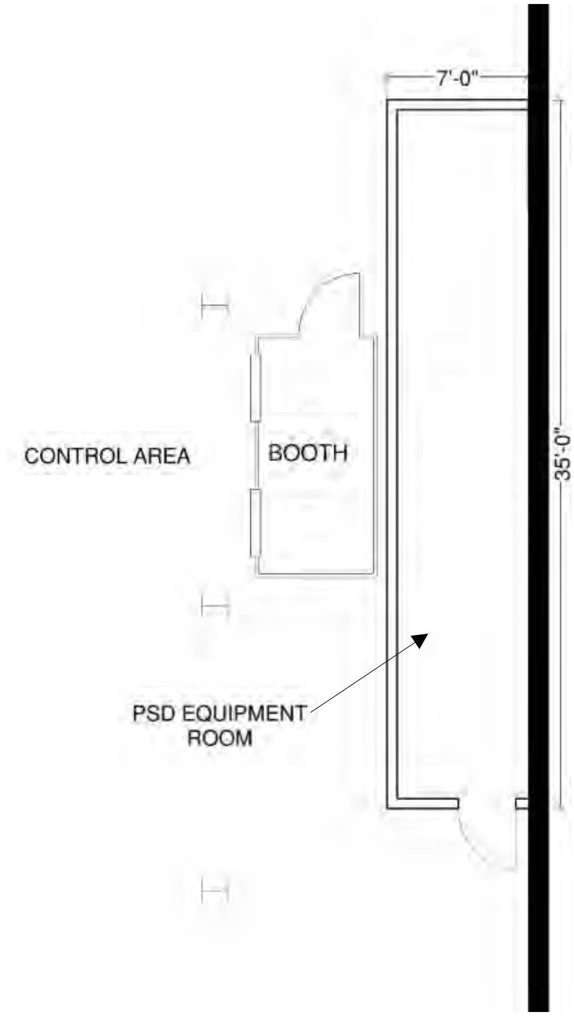

Figure 2 – PSD Equipment Room Detail - Jefferson St Station

Platform edge condition

Existing conditions: Platform edge appears to be original to station construction, and will therefore require reconstruction to support new platform APGs or PSDs. The 2012 NYCT condition survey report gave the platform edges a rating of 2.

Platform obstructions within 5' of edge:

Canarsie-bound: All columns are 41" from platform edge. One column is in front of an ADA - designated door; however, the condition is not exacerbated by the implementation of a platform edge barrier.

Manhattan-bound: All columns are 41" from platform edge. There are no other obstructions.

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

Power is adequate. See Electrical table below. Calculation is based on APG loads which are the most demanding.

Canarsie Line Station Electrical Capacity Analysis	
NYC T Station MR Number	126
Station Name	Jefferson St
Peak Demand Load from ConEd Report, Last 20 Months,(kW)	34.4
Peak Demand Load, Max Current (A)	119.4
PSD Total Load for N Doors, including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	284.4
Station Service Power Capacity, (A)	400.0
Service Spare Capacity, (A)	115.6
Electrical Service is Adequate or Not	Yes

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $28.1M to install APGs and $35.4M to install PSDs (See Appendix E).

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Figure 3 – Typical platform view- Jefferson St Station

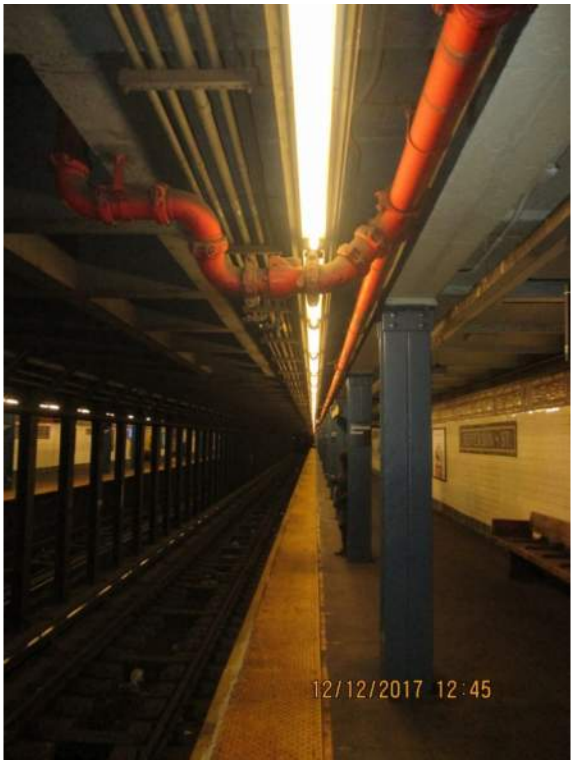

Figure 4 – Fire standpipe extending over platform edge with 7'-1" clearance (Manhattan-bound)—Jefferson St Station

1.8 Dekalb Avenue Station

Summary: Dekalb Avenue Station (MR-127) is feasible for both APGs and PSDs. One column is located in front of an ADA-designated door on the Canarsie-bound platform. The current non-complying condition would not be exacerbated by the implementation of a platform edge barrier. Platform structural work will be required to support the added load of the platform edge barrier (see structural report; Appendix B). Existing power is adequate.

Description

Dekalb Avenue is a below-grade station with straight side platforms. The platform structure is cast-in-place concrete. There are entries at both ends of the platforms with a mezzanine entry at the west end of the platform (intersection of Dekalb and Wyckoff). Back-of-house elements are situated at the east-end of both platforms as well as at the mezzanine level. Both platforms are approximately 12' wide with columns spaced approximately 15' on center. The column faces are 3'-5" from the edge of the platform. There is ceiling-mounted conduit above the platform edge. See figure 1 for an overall station plan and figure 3 for a typical platform view.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs): This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Existing wall-mounted conduit below the platform edge would need to be coordinated to accommodate the requirements of the APG system.

Equipment Room

An 8'-0" x 30'-0" PSD equipment room can be located at the southeast-end of the Manhattan bound platform (see figure 2).

Track Layout

Track is tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

Existing conditions: Platform edge appears to be original to station construction, and will therefore require reconstruction to support new platform APGs or PSDs. The 2012 NYCT condition survey report gave the platform edges a rating of 3.5.

Platform obstructions within 5' of edge:

Canarsie-bound: All columns are 41" from platform edge. One column is located in front of an ADA - designated door; however, the already non-compliant condition is not exacerbated by the implementation of a platform edge barrier.

Manhattan-bound: All columns are 41" from platform edge. There are no other obstructions.

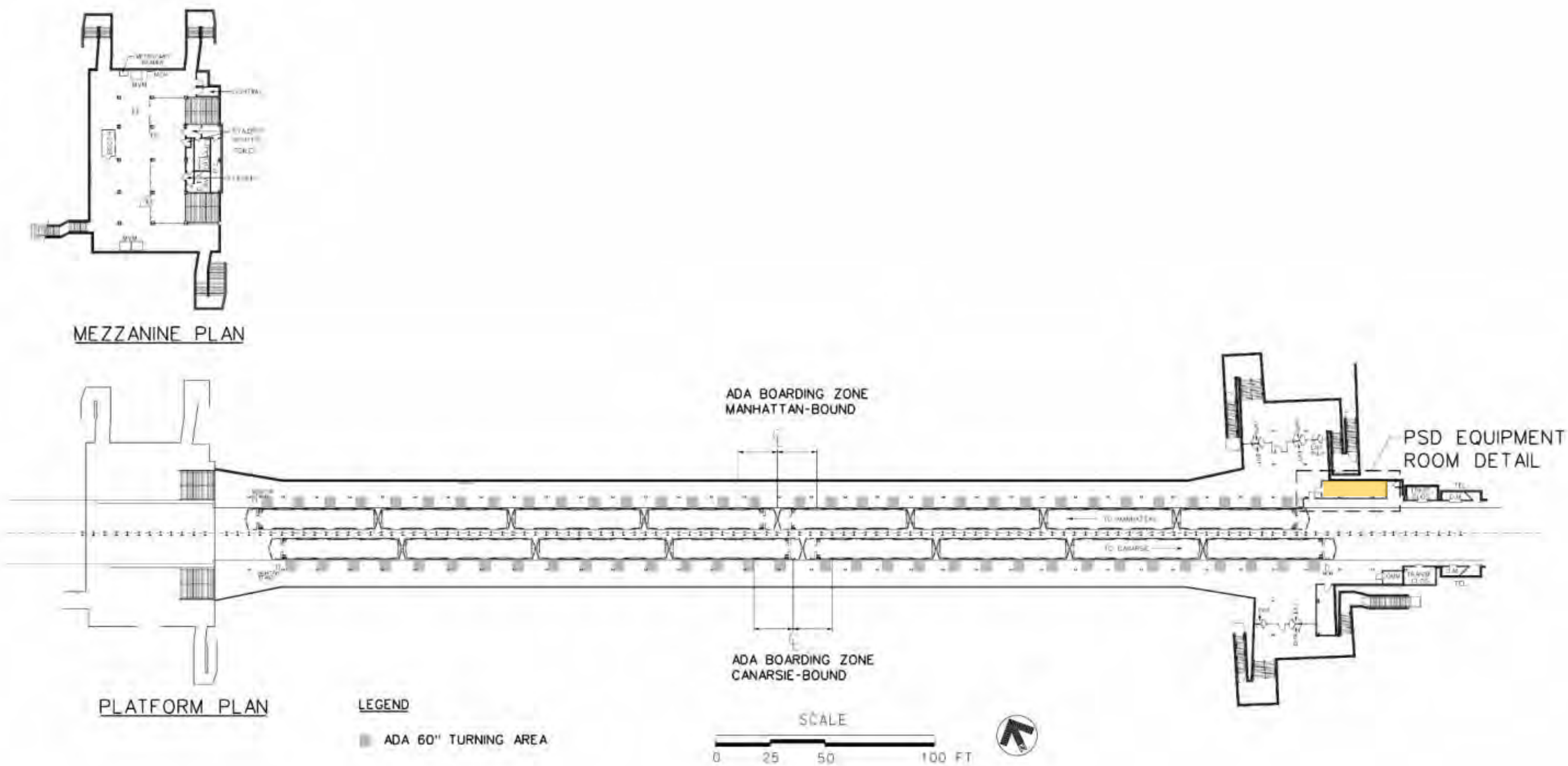

Figure 1 – Station Plan- Dekalb Avenue Station

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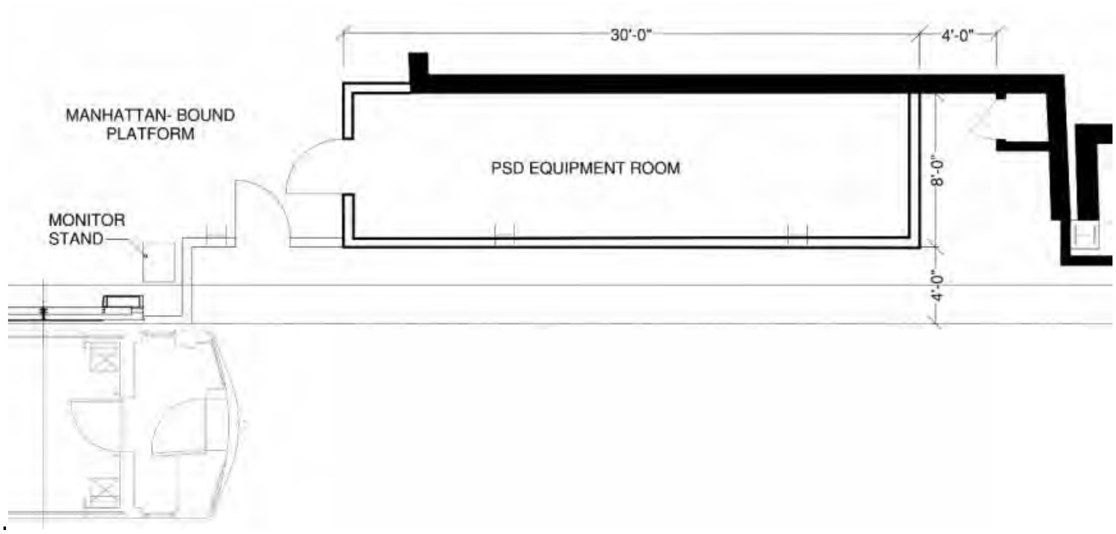

Figure 2 – PSD Equipment Room Detail – Dekalb Avenue Station

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

Power is adequate. See Electrical table below. Calculation is based on APG loads which are the most demanding.

Canarsie Line Station Electrical Capacity Analysis	
NYC T Station MR Number	127
Station Name	DeKalb Avenue
Peak Demand Load from ConEd Report, Last 20 Months,(kW)	36.6
Peak Demand Load, Max Current (A)	127.0
PSD Total Load for N Doors, including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	292.0
Station Service Power Capacity, (A)	400.0
Service Spare Capacity, (A)	108.0
Electrical Service is Adequate or Not	Yes

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $28.0M to install APGs and $35.4M to install PSDs (See Appendix E).

Figure 3– Typical Platform Edge Condition- Dekalb Avenue Station

1.9 Myrtle Wyckoff Avenue Station

Summary: Myrtle Wyckoff Avenue Station (MR-128) is feasible for both APGs and PSDs. There is a significant amount of conduit at and beyond the Canarsie-bound platform edge which present challenges for the installation of full-height PSDs. In addition, the implementation of full height PSDs will require rerouting of a standpipe over the Canarsie-bound tracks (see figure 3). Existing power is adequate.

Description

Myrtle Wyckoff Avenue Station is below-grade with a straight center/island platform. The platform structure is cast-in-place concrete. Back-of-house elements are located at the tapered ends of the platform. There are four staircases along the length of the platform and a centrally located elevator. The platform width is 19'-4". Columns are spaced approximately 15' on center and are located at the center of the platform. There is conduit above both platform edges, however at the Canarsie-bound side of the platform there is a lot of conduit that would have to be reconfigured. See figure 1 for an overall station plan.

Full Height PSDs: As noted above, full height PSDs would require the rerouting of a standpipe and reconfiguration of conduit. Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs): This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Existing wall-mounted conduit below the platform edge would need to be coordinated to accommodate the requirements of the APG system.

Equipment Room

A 12'-0" x 16'-0" PSD equipment room can be located at the mezzanine level in the control area (see figure 2).

Track Layout

Track is tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

Existing conditions: Platform edge appears to be original to station construction, and will therefore require reconstruction to support new platform APGs or PSDs. The 2012 NYCT condition survey report gave the platform edges a rating of 2.5.

Obstructions within 5' of edge:

Manhattan-bound: All columns are 4'-11" from the platform edge. There is an existing column in front of one of the ADA designated doors, but the required 60" turning radius is not impacted by this column.

Canarsie-bound: All columns are 4'-11" from the platform edge.

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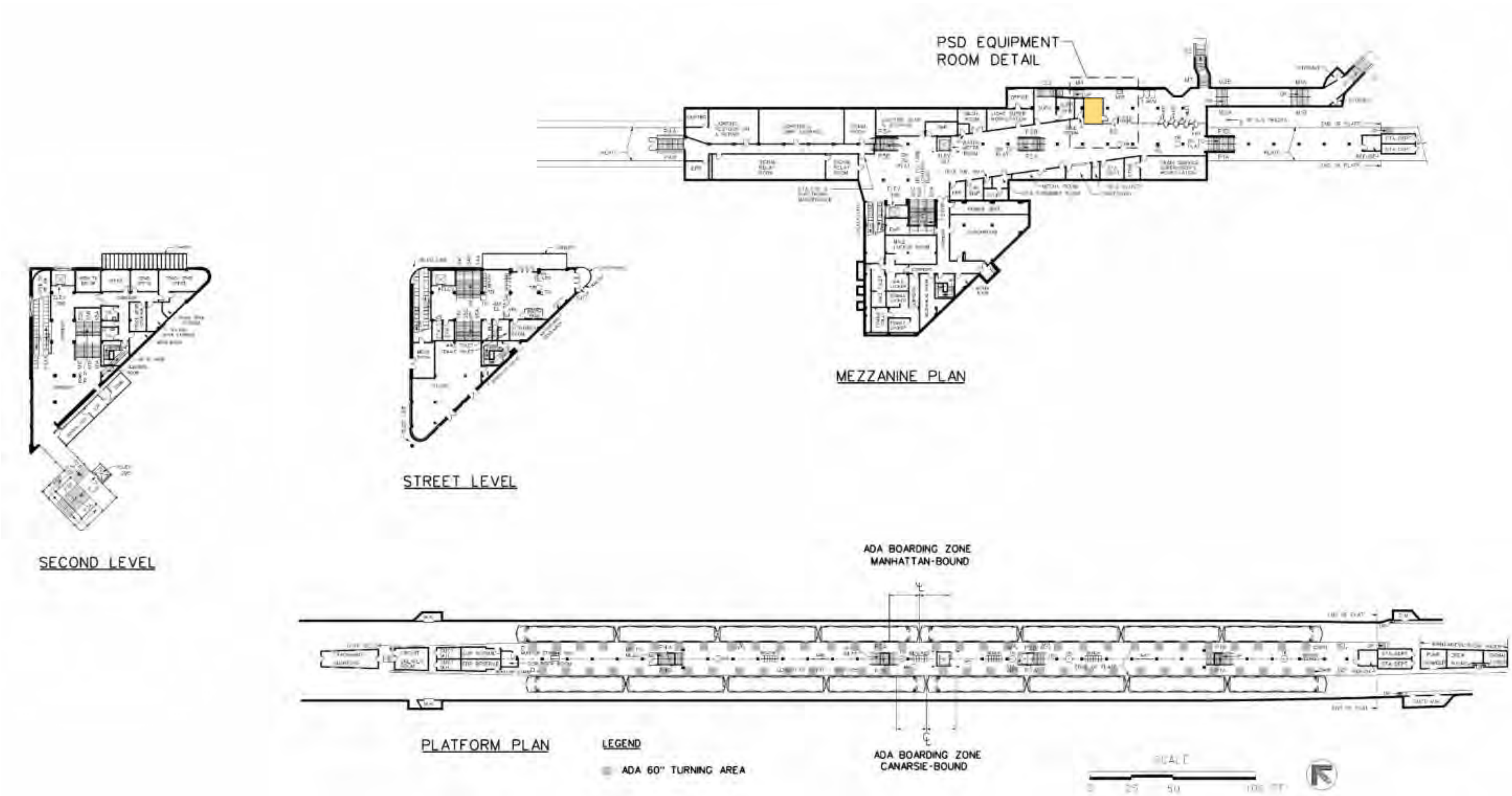

Figure 1 – Station Plan – Myrtle Wyckoff Avenue Station

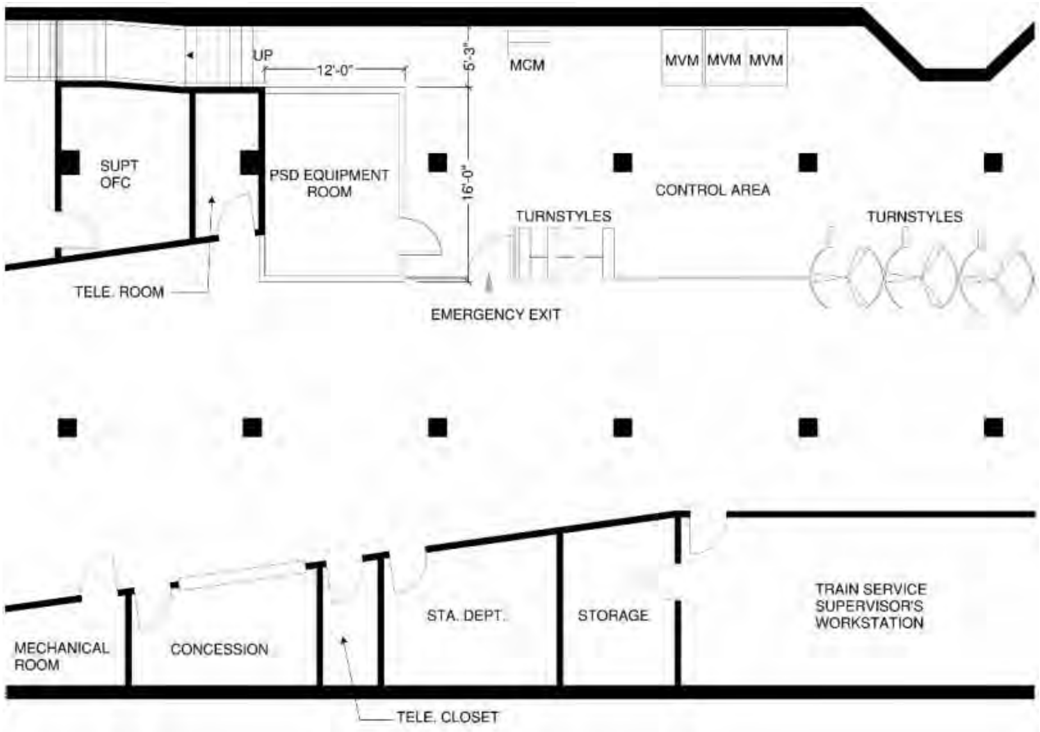

Figure 2 – PSD Equipment Room Detail – Myrtle Wyckoff Avenue Station

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

Power is adequate. See Electrical table on the following page. Calculation is based on APG loads which are the most demanding.

Canarsie Line Station Electrical Capacity Analysis	
NYC T Station MR Number	128
Station Name	Myrtle Ave–Wyckoff Ave
Peak Demand Load from ConEd Report, Last 20 Months,(kW)	81.6
Peak Demand Load, Max Current (A)	283.1
PSD Total Load for N Doors, including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	448.1
Station Service Power Capacity, (A)	1200.0
Service Spare Capacity, (A)	751.9
Electrical Service is Adequate or Not	Yes

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.9M to install APGs and $35.3M to install PSDs (See Appendix E).

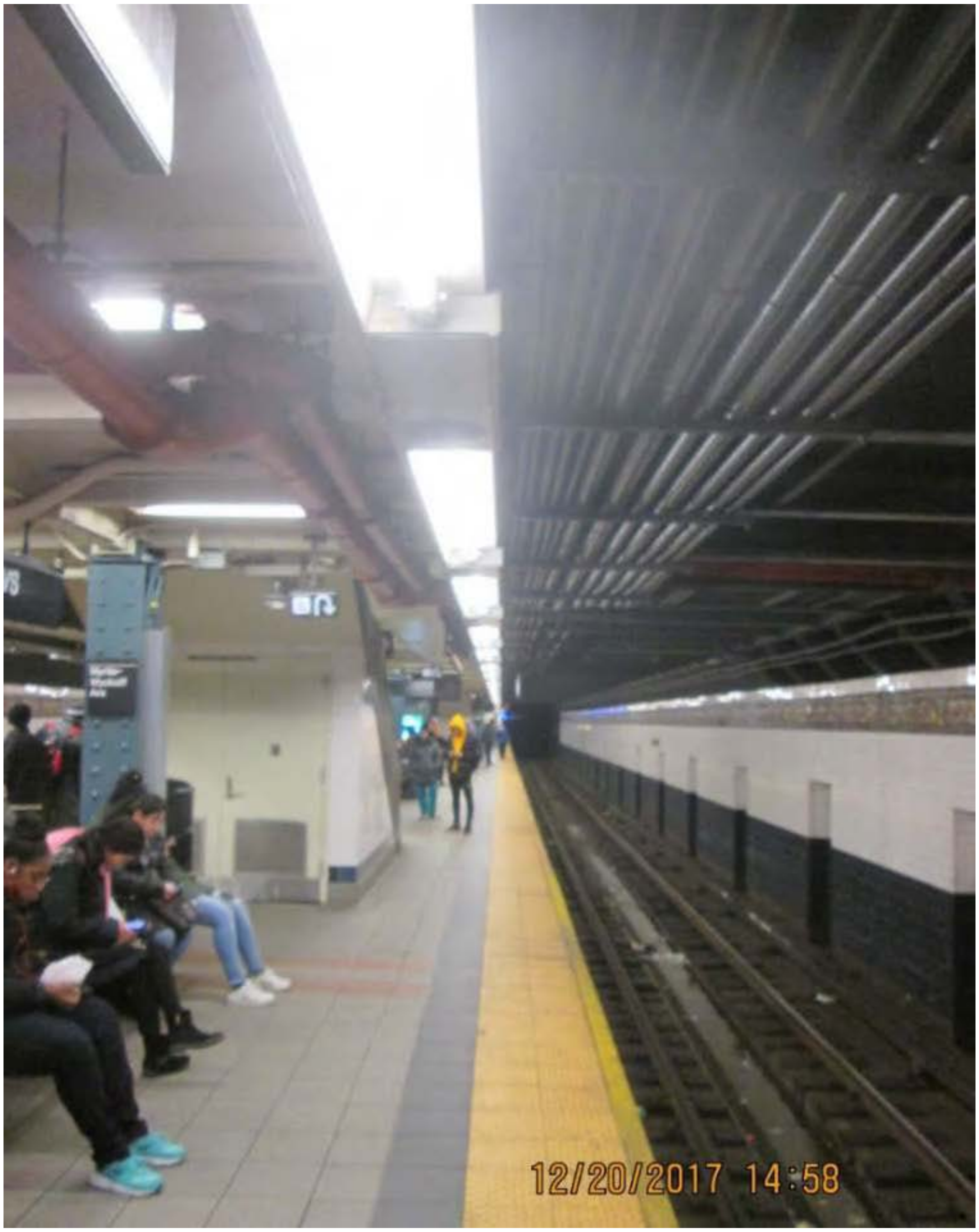

Figure 3 – Canarsie-bound: fire standpipe and conduit at/beyond platform edge– Myrtle Wyckoff Avenue Station

1.10 Halsey Street Station

Summary: *Halsey Street Station (MR-129) is feasible for both APGs and PSDs. On the Canarsie-bound platform, there is a column in front of an ADA-designated door. The current non-compliant condition would not be exacerbated in the implementation of a platform edge barrier. Platform structural work will be required to support the added load of the platform edge barrier (see structural report; Appendix B). Existing power is adequate.*

Description:

Halsey Street is a below-grade station with straight side platforms. The platform structure is cast-in-place concrete. Rather than being perfectly in line with each other, the platforms are shifted lengthwise by two subway cars. Both platforms are accessed at their ends. Both platforms are approximately 12' wide with columns spaced approximately 15' on center. Column faces are approximately 3'-4" (40") from the platform edge. There is ceiling-mounted conduit above the platform edge and wall-mounted conduit below the platform edge. See figure 1 for an overall station plan and figure 3 for a typical platform view.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Existing wall-mounted conduit below the platform edge would need to be coordinated to accommodate the requirements of the APG system.

Equipment Room

A 12'-0" x 16'-0" equipment room can be accommodated after the pay-gate at the George Street entrance on the Manhattan-bound side of the station (see figure 2).

Track Layout

Track is tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

Existing conditions: Platform edge appears to be original to station construction, and will therefore require reconstruction to support new platform APGs or PSDs. The 2012 NYCT condition survey report gave the platform edges a rating of 3.5.

Platform obstructions within 5' of edge:

Canarsie-bound: All columns are 40" from platform edge. One column is centered on the ADA - designated door; however, the condition is not exacerbated by the implementation of a platform edge barrier.

Manhattan-bound: All columns are 40" from platform edge. There are no other obstructions.

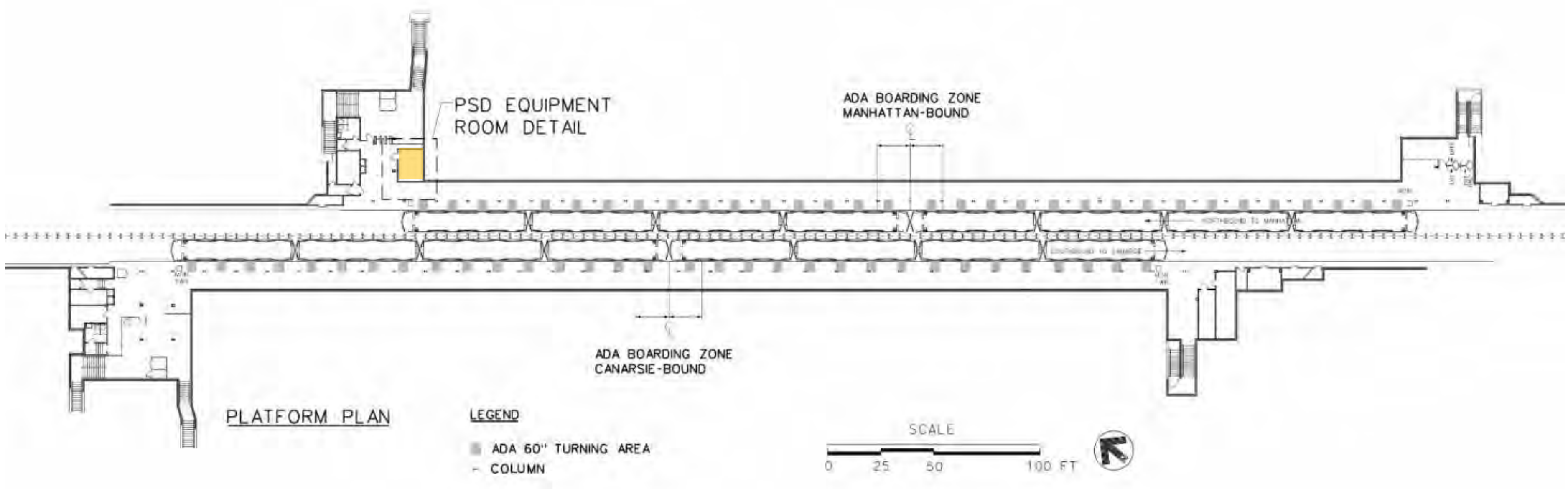

Figure 1 – Station Plan- Halsey St Station

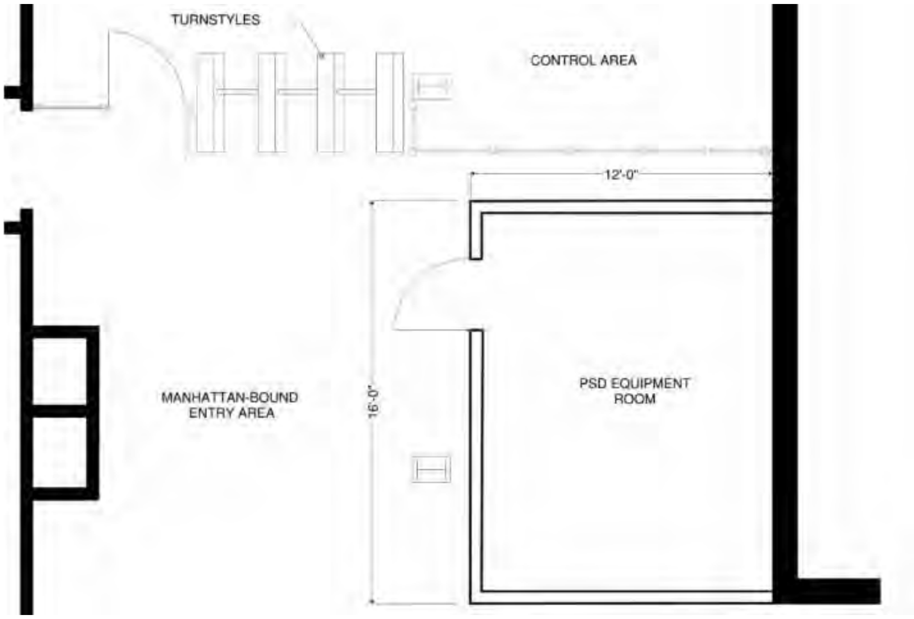

Figure 2 – PSD Equipment Room Detail- Halsey St Station

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

Power is adequate. See Electrical table below. Calculation is based on APG loads which are the most demanding.

Canarsie Line Station Electrical Capacity Analysis	
NYC T Station MR Number	129
Station Name	Halsey St
Peak Demand Load from ConEd Report, Last 20 Months,(kW)	34.0
Peak Demand Load, Max Current (A)	118.0
PSD Total Load for N Doors, including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	283.0
Station Service Power Capacity, (A)	400.0
Service Spare Capacity, (A)	117.0
Electrical Service is Adequate or Not	Yes

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $28.0M to install APGs and $35.3M to install PSDs (See Appendix E).

Figure 3– Typical Platform View– Halsey St Station

1.11 Wilson Avenue Station

Summary: *Wilson Avenue Station (MR-130) is feasible for both APGs and PSDs. The Wilson Avenue station has one track at-grade (Canarsie-bound) and one track below-grade (Manhattan-bound). To accommodate an equipment room on the Manhattan-bound platform, the stop line needs to be adjusted (moved approximately 6'-6"). In doing so, an existing obstruction at the ADA boarding zone is eliminated. Platform structural work will be required to support the added load of the platform edge barrier (see structural report; Appendix B). Existing power is adequate.*

Description

Wilson Avenue Station is a unique station, unlike any other on the 'L" Line. The Canarsie-bound and Manhattan-bound platforms are stacked on top of one another. The Canarsie-bound platform is at-grade, while the Manhattan-bound platform is below-grade. Both platforms are straight and made of cast-in-place concrete. The Canarsie-bound platform is 12'-10" wide, columns are located against the platform wall and the face of the column is 11'-4" from the edge of the platform. The Manhattan-bound platform is approximately 11'-10" wide, the face of the columns are typically 3'-2" from the platform edge. On both platforms, columns are spaced approximately 15' on center. The canopy of the Canarsie-bound platform extends 1'-6" beyond the platform edge. Hanging from the canopy on the Canarsie-bound platform, is a cable tray located within 2' of the platform edge with a vertical clearance of 8'-2". There is also signage at the platform edge (see Figure 4). The Manhattan-bound platform has seven ceiling-mounted conduits above and beyond the platform edge (see Figure 5). See figure 1 for an overall station plan.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling/canopy as well as reconfiguration of existing ceiling/canopy-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. On the Canarsie-bound platform, there is conduit mounted below the platform edge as well as a large pipe at track-level that runs the length of the platform with smaller pipes running beneath the platform structure. These items would need to be coordinated in the implementation of APGs.

Equipment Room

Two PSD equipment rooms are needed. One room can be located at the north end of both platforms (rough/approximate dimensions: 7' x 16'-6"). To accommodate this room on the Manhattan-bound platform, the stop line would need to be moved by approximately 7 feet. See Figures 2 and 3 for PSD equipment room enlargements (see figures 2 and 3).

Track Layout

Track is tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

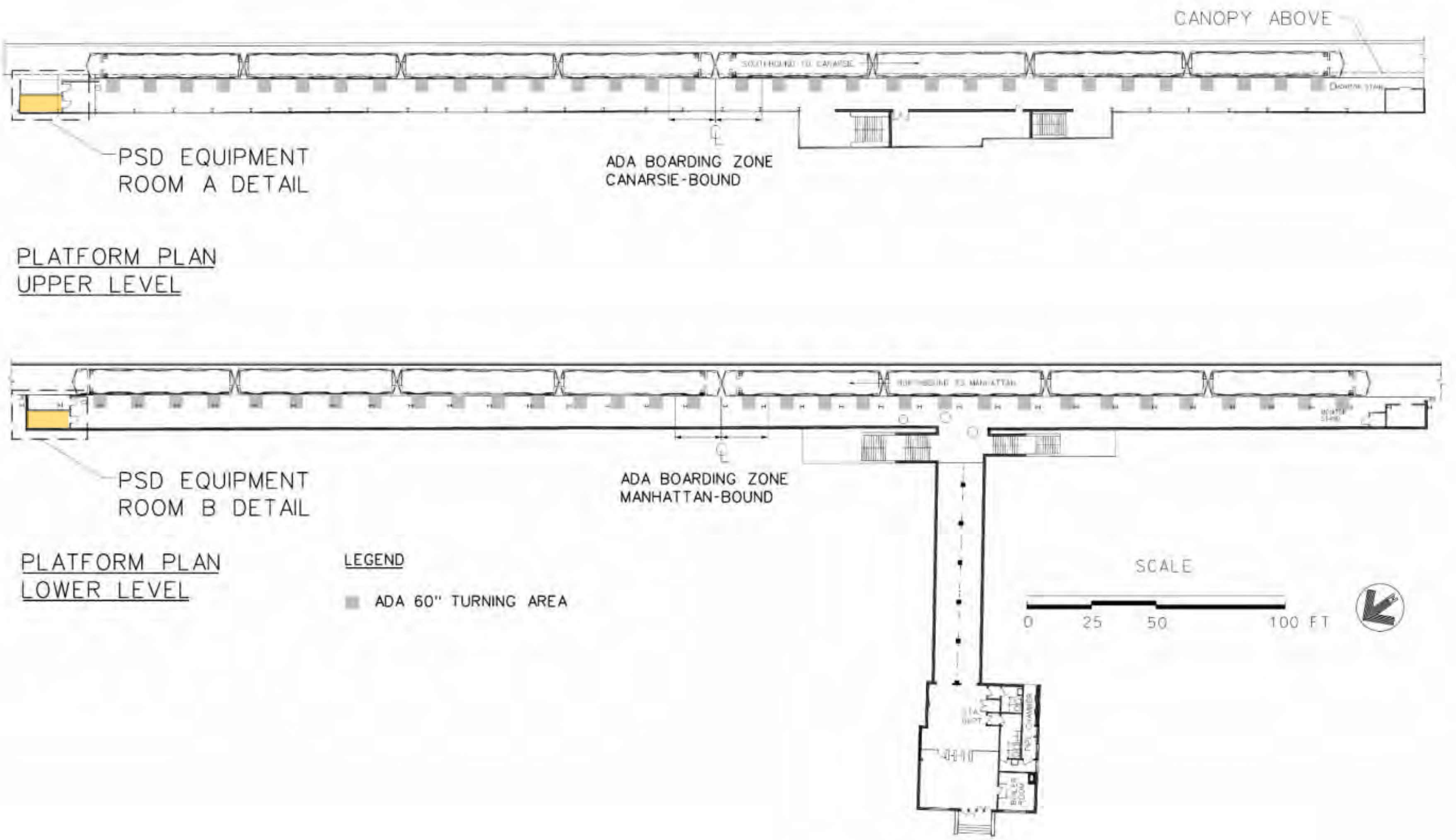

Figure 1- Station Plan – Wilson Avenue Station

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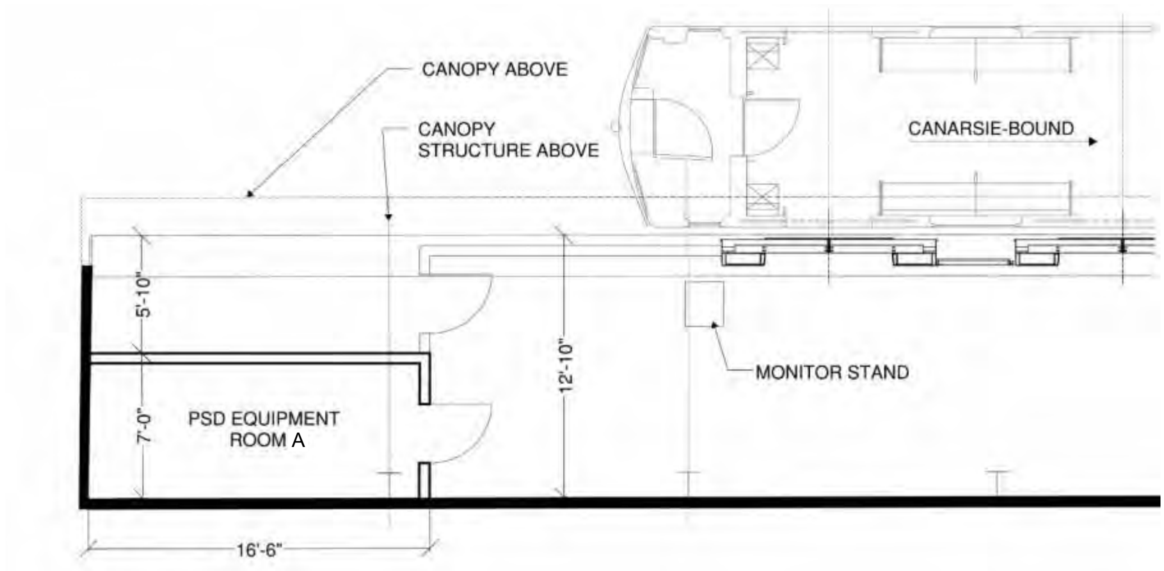

Figure 2 – PSD Equipment Room A Detail (Upper Level) – Wilson Avenue Station

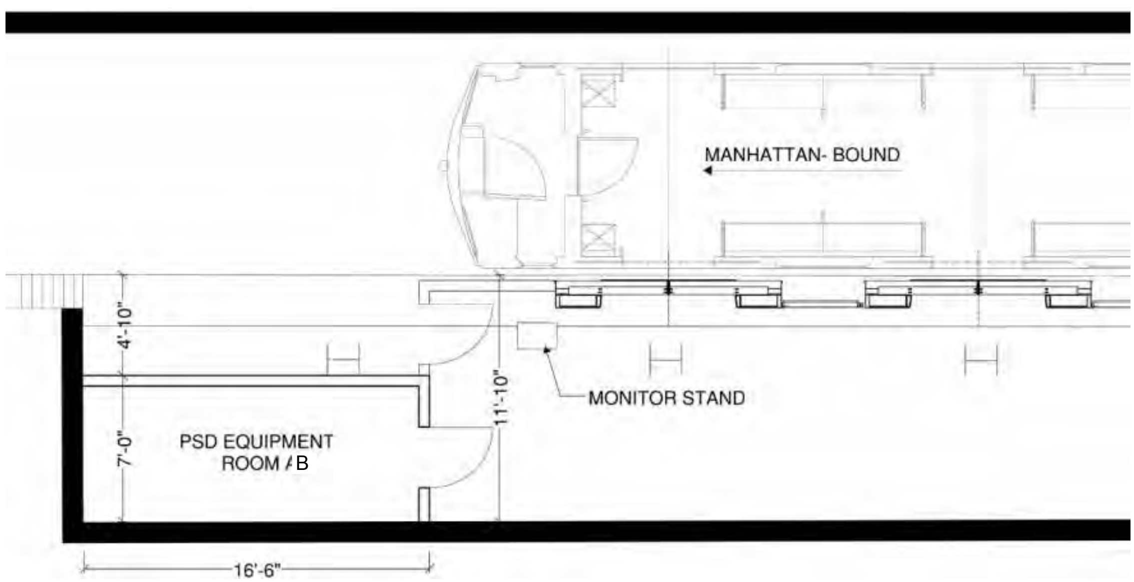

Figure 3 – PSD Equipment Room B Detail (Lower Level) – Wilson Avenue Station

Platform edge condition

Existing conditions: Platform edge appears to be original to station construction, and will therefore require reconstruction to support new platform APGs or PSDs. The 2012 NYCT condition survey report gave the platform edges a rating of 3 and 4.

Platform obstructions within 5' of edge:

Canarsie-bound: There are no obstructions.

Manhattan-bound: All columns are 41" from platform edge. Presently, one column is in front of the ADA - designated door. However, due to the need to adjust the stop line, this obstruction can be remedied while not compromising other doors.

Lighting:

Existing lighting: On the Manhattan-bound platform linear fluorescent light fixtures are approximately 24" from the platform edge. The Canarsie-bound platform linear fluorescent lighting is hung 3'-6" from the platform edge with a vertical clearance of 7'-4" to the bottom of the fixture. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

Power is adequate. See Electrical table below. Calculation is based on APG loads which are the most demanding

Canarsie Line Station Electrical Capacity Analysis	
NYC T Station MR Number	130
Station Name	Wilson Avenue
Peak Demand Load from ConEd Report, Last 20 Months,(kW)	37.6
Peak Demand Load, Max Current (A)	130.5
PSD Total Load for N Doors, including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	295.5
Station Service Power Capacity, (A)	400.0
Service Spare Capacity, (A)	104.5
Electrical Service is Adequate or Not	Yes

Historic Restrictions:

Wilson Avenue Station is a historically designated property. As such, design will require review by the New York State Historic Preservation Office.

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $28.7M to install APGs and $35.7M to install PSDs (See Appendix E).

Figure 4 – Edge of Platform Condition, Canarsie-bound – Wilson Avenue Station

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Figure 5 – Edge of Platform Condition, Manhattan-bound – Wilson Avenue Station

1.12 Bushwick Avenue Station

Summary: Bushwick Avenue Station (MR-131) is feasible for both APGs and PSDs. On the Manhattan-bound platform, there is a column located in front of an ADA-designated door. The current non-complying condition would not be exacerbated by the implementation of a platform edge barrier. Platform structural work will be required to support the added load of the platform edge barrier (see structural report; Appendix B). Existing power is adequate.

Description

Bushwick Avenue Station is a below-grade station with two curved platforms. Stair access is available near middle of both platforms. The platform structures are cast-in-place concrete. Both platforms are approximately 11'-8" wide with columns spaced approximately 15' on center. On both platforms, columns have a tile surround; the faces of the columns are approximately 3'-0" from the platform edge. See figure 1 for an overall station plan and figure 3 for a typical platform view.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs): This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Wall-mounted conduit below the platform edge would need to be coordinated to accommodate the requirements of the APG system.

Equipment Room

One PSD equipment room measuring approximately 8'-0" x 30'-0" can be located at the north end of the Manhattan-bound track platform (see figure 2).

Track Layout

Track is mildly curved. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

Existing conditions: Platform edge appears to be original to station construction, and will therefore require reconstruction to support new platform APGs or PSDs. The 2012 NYCT condition survey report gave the platform edges a rating of 3.5

Platform obstructions within 5' of edge:

All columns are approximately 3'-0" from the platform edge. On Manhattan-bound track platform, there is a column located in front of an ADA-designated door. The current non-complying condition would not be exacerbated by the implementation of a platform edge barrier.

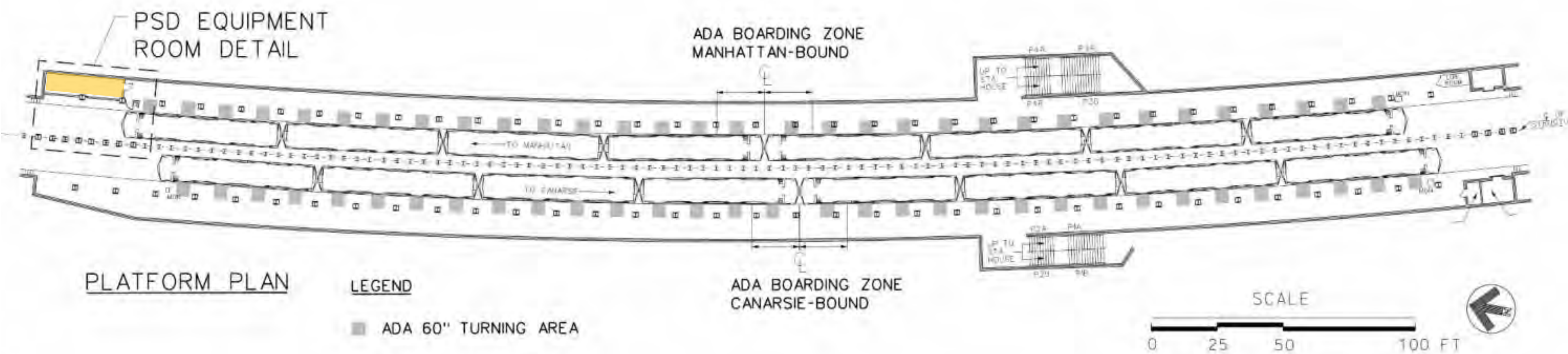

Figure 1- Station Plan - Bushwick Avenue Station

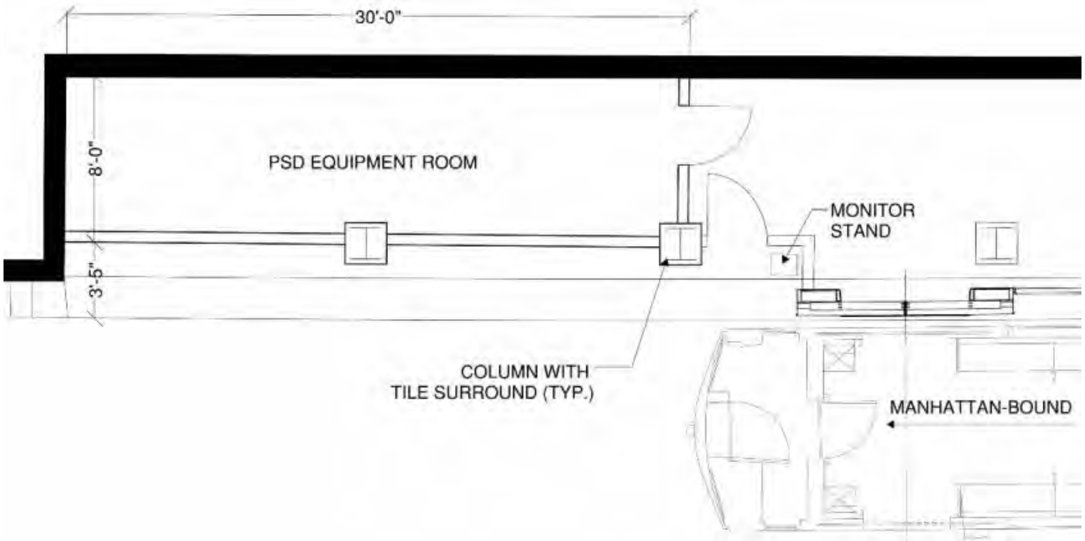

Figure 2 – PSD Equipment Room Detail - Bushwick Avenue Station

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

Power is adequate. See Electrical table below. Calculation is based on APG loads which are the most demanding.

Canarsie Line Station Electrical Capacity Analysis	
NYC T Station MR Number	131
Station Name	Bushwick Av - Aberdeen St
Peak Demand Load from ConEd Report, Last 20 Months,(kW)	39.6
Peak Demand Load, Max Current(A)	137.4
PSD Total Load for N Doors, including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	302.4
Station Service Power Capacity, (A)	400.0
Service Spare Capacity, (A)	97.6
Electrical Service is Adequate or Not	Yes

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $28.6M to install APGs and $35.4M to install PSDs (See Appendix E).

Figure 3 – General view of Canarsie-bound track platform – Bushwick Avenue Station

1.13 Broadway Junction Station

Summary: Broadway Junction Station (MR-132) is feasible for APGs only. As the station has minimal canopy coverage, PSDs would not be feasible. On the Manhattan-bound platform, there is a column located in front of an ADA designated door. The current non-complying condition would not be exacerbated by the implementation of a platform edge barrier. Existing power is adequate.

Description

Broadway Junction Station is an elevated station with one side platform and one center/island platform. The platform structure is made of cast-in-place concrete. Stair access is available at the middle of both platforms. The south end of the center platform widens as the Manhattan-bound track curves eastward. As the center platform widens, the number of column rows increases from 1 to 3. The columns are typically 5'-0" away from both edges of the center platform. The Manhattan-bound platform width varies from approximately 12'-0" to approximately 40'-0". The Canarsie-bound track is tangential to the platform. The platform width varies from approximately 10'-8" to 18'-4". There are columns that support the cantilever station canopy; these columns are typically 10'-4" from edge of platform and are spaced approximately 17'-7" on center. See figure 1 or an overall station plan and figure three for a typical platform view.

Full Height PSDs: As noted in the summary, full height PSDs are not feasible at this station due to the absence of structural support overhead. A new steel overhead structure would be required in areas without a canopy; therefore adding weight, costs, and maintenance.

Half Height PSDs (aka APGs): This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. At parts of the platform not covered by a canopy, minimal overhead structures would be required to support cameras and sensors.

Equipment Room

Space required for one equipment room (16' x 12') is available at the south side of the center platform (see figure 2).

Track Layout

Track is tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

Existing conditions: The platform edge appears to have been updated recently, so it is not likely that structural work would be needed. The 2012 NYCT condition survey report gave the platform edges a rating of 2.5 and 2.0.

Platform obstructions within 5' of edge:

Manhattan-bound: All columns are 5'-0" away from the platform edge. One column is in front of an ADA - designated door; however, the condition is not exacerbated by the implementation of a platform edge barrier.

Canarsie-bound: All columns are approximately 10'-4" from the platform edge. There are no other obstructions.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn
(Broadway Junction Station)

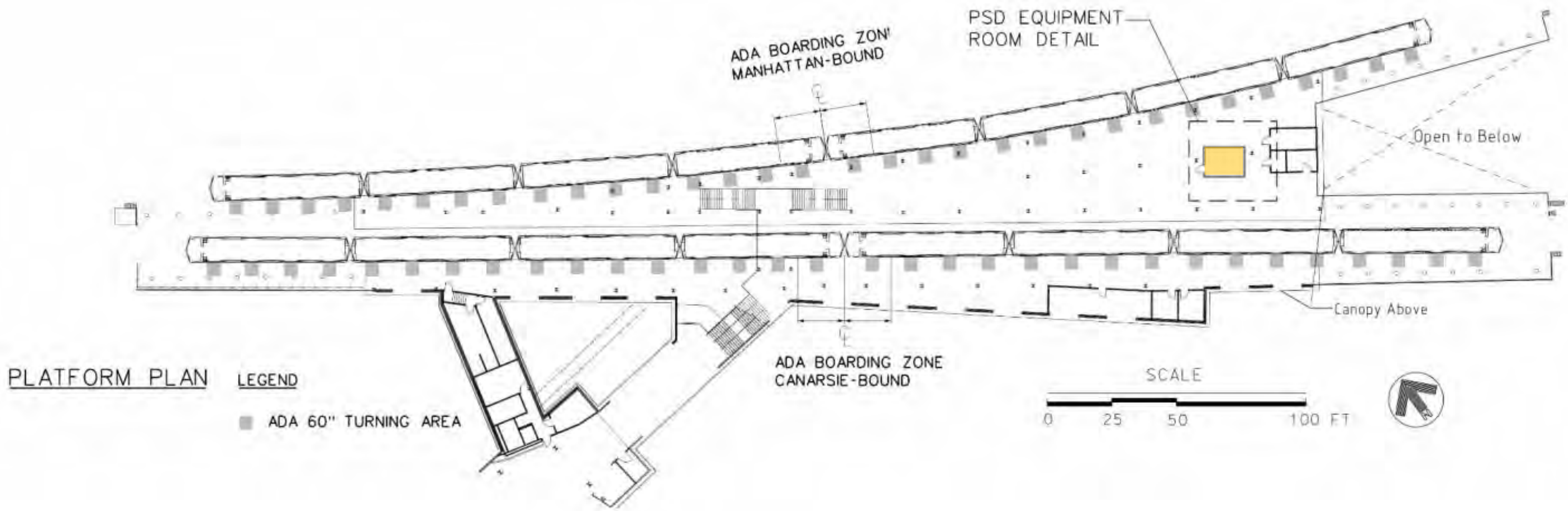

Figure 1 - Station Plan – Broadway Junction Station

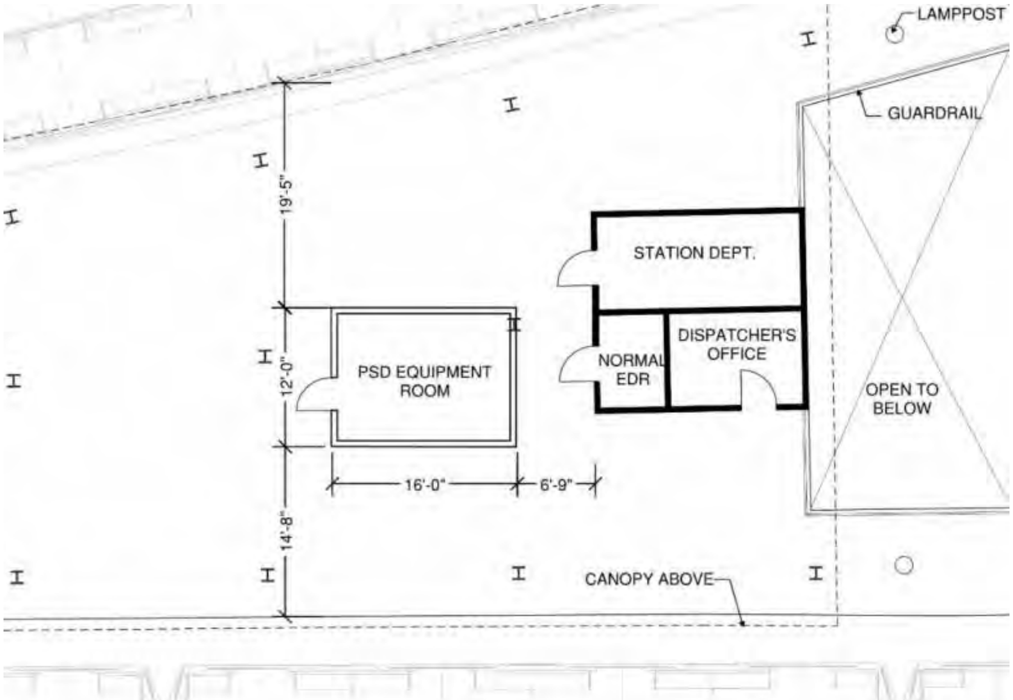

Figure 2– PSD Equipment Room Detail – Broadway Junction Station

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge (in areas covered by a canopy). Depending on the specific APG design used, there could be no or minimal alterations to the existing lighting configuration. Where there is no canopy, lampposts are located in the center of the platforms.

Power:

Power is adequate. See Electrical table below. Calculation is based on APG loads which are the most demanding (and APGs are the only feasible option at this station).

Canarsie Line Station Capacity Analysis	
NYC T Station MR Number	132
Station Name	Broadway Junction
Peak Demand Load from ConEd Report, Last 20 Months,(kW)	156.0
Peak Demand Load, Max Current (A)	541.3
PSD Total Load for N Doors, including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	706.3
Station Service Power Capacity, (A)	1600.0
Service Spare Capacity, (A)	893.7
Electrical Service is Adequate or Not	Yes

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $27.9M to install APGs (See Appendix E).

Figure 3 – Uncovered platform with canopy in the distance– Broadway Junction Station

1.14 Atlantic Avenue Station

Summary: *Atlantic Avenue Station (MR-133) is not feasible for APGs or PSDs because an existing non-compliant condition in the ADA boarding zone would be exacerbated (see figure 3). Figure 2 locates the ADA boarding zone on the overall station plan. Contributing to this finding are other constraints including the width of the platform. The platform is 15'-3" wide, which does not meet the minimum required center/island platform width of 15'-10" for emergency egress with platform edge barriers implemented (see Emergency Egress Width Analysis; Appendix C).*

Description

The Atlantic Avenue Station is elevated, consisting of one tangent platform serving two tracks. The platform structure is cast in place concrete. The platform has two (2) rows of columns spaced 3'-5" from the edge of the platform at 20'-0" intervals for the length of the canopy. The canopy covers only 2/3 of the platform. The platform has a typical width of 15'-3" (see figure 1).

Figure 1 – General view of platform width and canopy – Atlantic Avenue Station

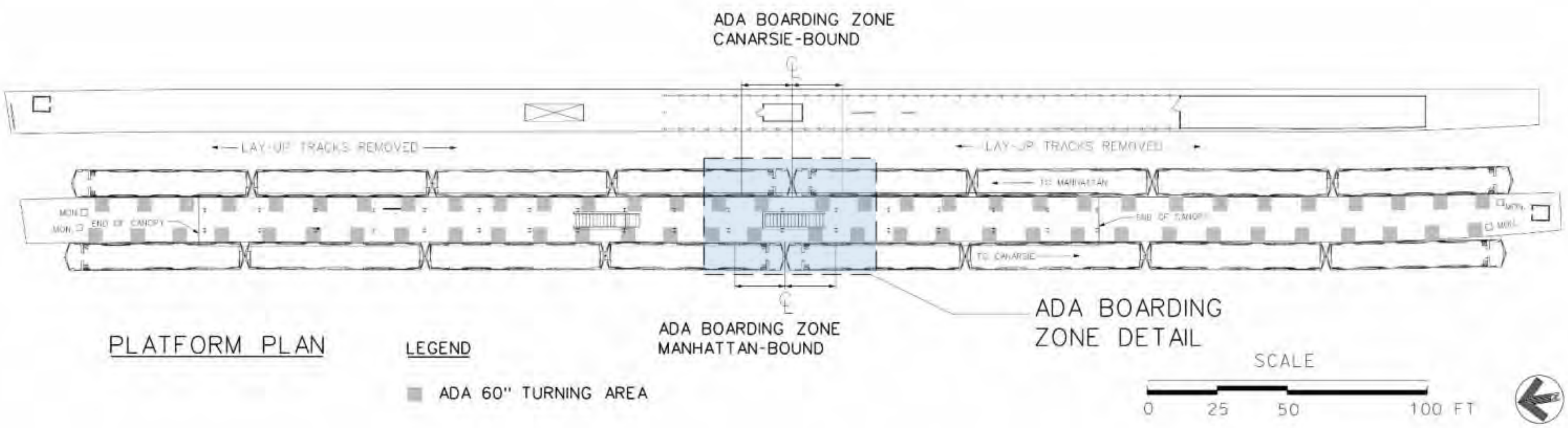

Figure 2 – Station Plan – Atlantic Avenue Station

Obstructions within 5' of edge:

Manhattan Bound: All columns are 3'-5" the platform edge. At the ADA boarding zone, there is a stair 5-0" from the platform edge. While the required turning radius is met, the implementation of a platform edge barrier would create very narrow/non-compliant circulation widths to the sides of this stair and adjacent columns.

Brooklyn Bound: All columns are 3'-5" from the platform edge. At the ADA boarding zone, there is a stair 4'-7" from the platform edge. At one of the doors, this would exacerbate an already non-compliant condition (see figure 3). Adjusting the stop line would not remedy the issue as there would continue to be interference with the stair.

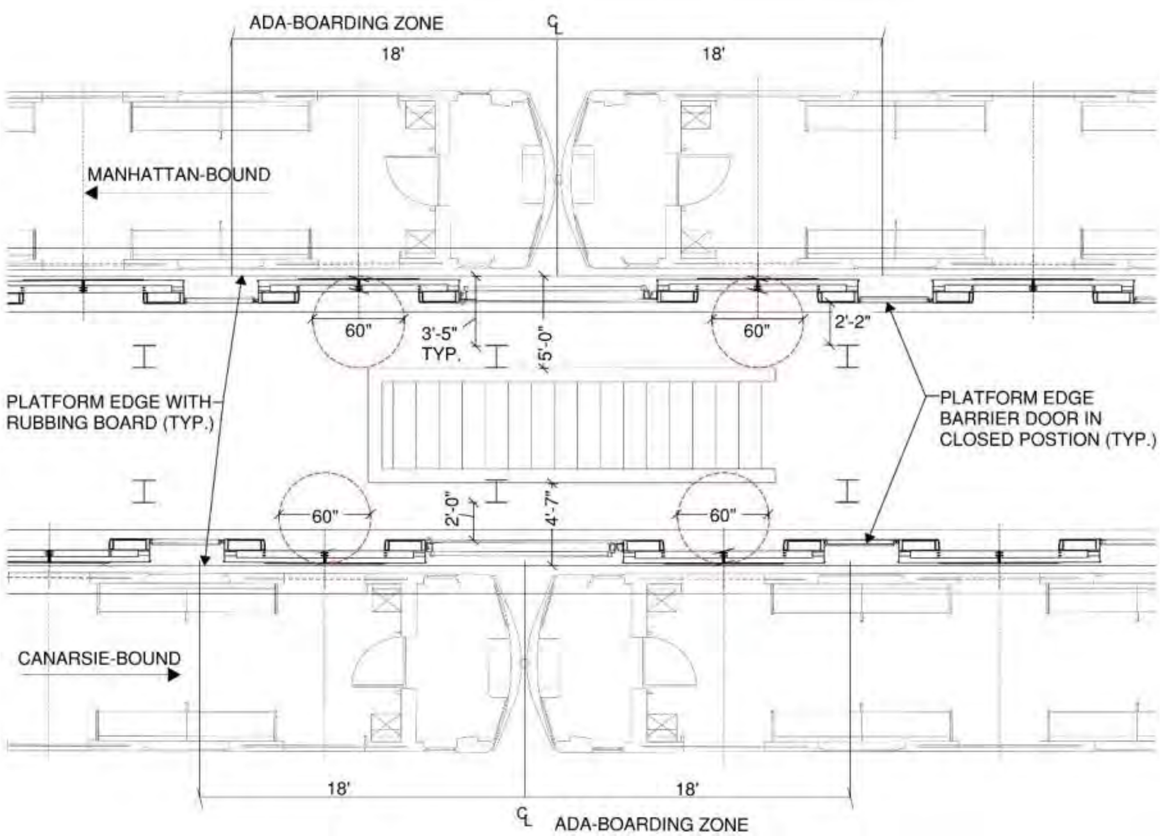

Figure 3 – ADA Boarding Zone Detail – Atlantic Avenue Station

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1.15 Sutter Avenue Station

Summary: Sutter Avenue Station (MR-134) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2).

Description

Sutter Avenue Station is an elevated station with two side platforms. Both platforms are straight with columns along the back wall of the platform. The canopy covers the majority of the station, with a small part of the north-end uncovered. The platforms have a typical width of 7'-6" with 6'-0" clear to the face of the columns. See figure 1 for a typical platform view.

Figure 1 – Typical Platform View- Sutter Avenue Station

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Figure 2 – Precast T-Beam platform - Sutter Avenue Station

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1.16 Livonia Avenue Station

Summary: Livonia Avenue Station (MR-135) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform (see structural report; Appendix B and figure 3). Contributing to this finding is the location of a staircase on the Manhattan-bound platform. Staircase P2 is located 12" away from the platform edge; 15" are needed to accommodate a platform edge barrier (see Figure 2).

Description:

Livonia Avenue Station is an elevated station consisting of two side platforms serving Manhattan-bound and Canarsie-bound tracks. Each platform has a tangent geometry with one row of columns approximately 6'-0" from the edge of the platform. These columns are approximately 10'-0" on center, and support the station canopy. The canopy only covers the middle third of the platform. See figure 1 for a typical platform view of Livonia Avenue Station.

Figure 1 – Canarsie-bound platform, typical platform condition– Livonia Avenue Station

Figure 2 – Manhattan-Bound track platform, Staircase P3 is 12" away from platform edge – Livonia Avenue Station

Figure 3 – Elevated Precast T-Beam platform – Livonia Avenue Station

1.17 New Lots Avenue Station

Summary: *New Lots Avenue (MR-136) is not feasible for APGs or PSDs as parts of the Canarsie-bound platform are 5'-7" wide, which does not meet the minimum required side platform width of 5'-11" for emergency egress with platform edge barriers implemented (see Emergency Egress Width Analysis; Appendix C and figure 1). In addition, on the Manhattan-bound platform, a stair is located 12" away from the platform edge; 15" are needed to accommodate a platform edge barrier.*

Description

New Lots Avenue is an elevated station consisting of two side platforms serving Manhattan-bound and Canarsie-bound tracks. Each platform has a tangent geometry with one row of columns that are 5'-7" away from the platform edge. These columns are spaced 15'-0" on center, which support the station canopy. The canopy covers about one half of the platform length.

On the Manhattan-bound platform, staircase P3 located 12" from the platform edge. This staircase does not allow for the installation of the barrier. (See Figure 2)

Figure 1–Columns are typically 5'-7" from the platform edge– New Lots Avenue Station

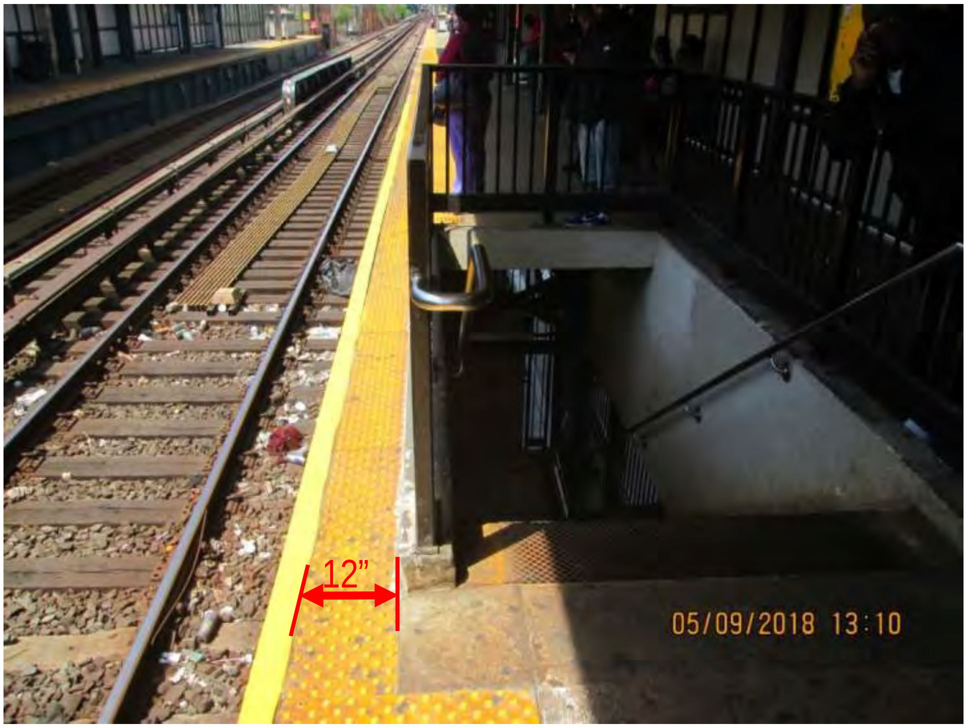

Figure 2– Manhattan-Bound track platform, Staircase P3 is 12" away from platform edge – New Lots Avenue Station

1.18 East 105th Station

***Summary:** East 105th Station (MR-137) is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 2).*

Description:

East 105th Station is an at-grade station consisting of one center/island platform serving two tracks. The platform is 10'-4" wide. The platform is straight with one row of columns spaced 20'-0" on center, supporting the station canopy. The canopy only covers approximately one quarter of the platform length. See figure 1 for a general platform view of East 105th Station.

Figure 1– General Platform Condition – East 105th Station

Figure 2– Precast T-Beam platform – East 105th Station

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1.19 Rockaway Parkway Station

Summary: Rockaway Parkway (MR-138) is not feasible for APGs or PSDs. There is a portion of the platform where the effective cumulative width for passenger movement is approximately 9'-0" wide, which does not meet the minimum required center/island platform width of 9-10" for emergency egress with platform edge barriers implemented (see Emergency Egress Width Analysis; Appendix C).

Description:
Rockaway Parkway Station is an at-grade station consisting of one center/island platform serving two tracks. It is the terminating station of the L-line in Canarsie. The platform structure is cast-in-place concrete. The platform has a tangent geometry with two rows of columns with longitudinal spacing of 20'-0" on center. Track 1 (West) has column faces that are 3'-5" from the edge of the platform and Track 2 (East) has column faces that are 3'-10" from the edge of the platform. The platform width varies from 16'-6" to 24'-8". At the north-end, the platform divides due to an office structure in the middle, resulting in a platform width at the east-side of 4'-7" wide (see Figure 1) and west-side of 4'-5" for approximately 80' of the platform length.

Figure 1 –Effective platform width at Track 2 side, looking south- Rockaway Parkway Station

1.20 8th Avenue Station

Summary: 8th Avenue Station (MR-115) is feasible for both APGs and PSDs. Platform structural work will be required to support the added load of an APG platform edge barrier, though a PSD barrier could be supported without any additional structural work (see structural report; Appendix B). Existing power is adequate.

Description

The 8th Avenue Station is below-grade with a straight center/island platform. It is a terminal station. The platform structure is cast-in-place concrete. Back-of-house elements are located at the ends of the platform and in the mezzanine. There are four staircases along the length of the platform and a centrally located elevator. The platform width is 19'-4". Columns are spaced approximately 15' on center and are located 4'-3" from the platform edge. There is a significant amount of ceiling-mounted conduit above the northern platform edge. See figure 1 for an overall station plan. Figures 3 and 4 show platform conditions.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs): This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Existing wall-mounted conduit below the platform edge would need to be coordinated to accommodate the requirements of the APG system.

Equipment Room

An 8'-0" x 30'-0" PDS equipment room can be located in the middle of the platform, adjacent to the Ejector room.

Track Layout

Track is nearly tangent, although it is slightly curved at the east end of platform. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

Existing conditions: The station platform was recently renovated according to NYCT structural / architectural standards. As such, it can sustain the load of PSD installation, however it must be reconstructed for installation of APGs.

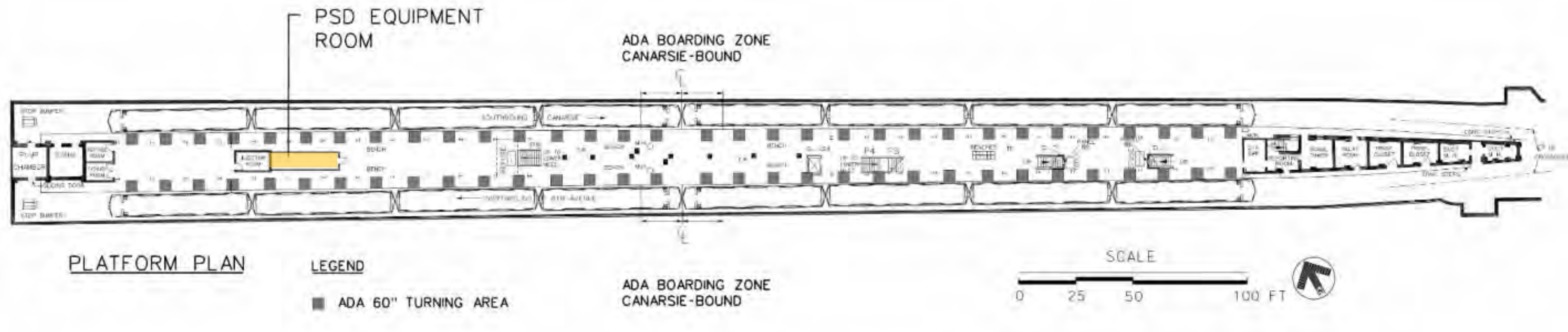

Figure 1 – Station Plan – 8st Avenue Station

Platform obstructions within 5' of edge:

Northern platform: columns are approximate 4'-3" from platform edge at most locations. As such, there are no physical obstructions which limit accessibility.

Southern platform: columns are approximate 4'-3" from platform edge at most locations. As such, there are no physical obstructions which limit accessibility with the exception of Elevator EL-224 which sits 4'-0" away from the platform edge, thereby obstructing the ADA turning radius. However, the introduction of platform edge barriers will not further impact accessibility.

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge. Not expected to be an issue for installation of platform edge barriers.

Power:

Power is adequate. See Electrical table below. Calculation is based on APG loads which are the most demanding.

Canarsie Line Station Electrical Capacity Analysis	
NYCT Station MR Number	115
Station Name	8 Avenue
Peak Demand Load from ConEd Report, Last 20 Months,(kW)	98.8
Peak Demand Load, Max Current (A)	342.8
PSD Total Load for N Doors, including All Miscellaneous Loads, (A)	165.0
Total Load (Station Peak + PSD), (A)	507.8
Station Service Power Capacity, (A)	800.0
Service Spare Capacity, (A)	292.2
Electrical Service is Adequate or Not	Yes

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Historic Restrictions:

None

Figure 2 – 8th Avenue Platform

Figure 3 – 8th Avenue Platform at elevator

Appendix A: Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*
>
> a. *Column location in relation to the platform edge*
> b. *Platform edge clearance adjacent to stairs and other impediments*
> c. *Impacts to ADA path of travel and boarding areas*
> d. *Conflicts of PSD/APG/RPSDs with Signals cables*
> e. *Sufficient platform width*
> f. *Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*
>
> a. *Structural capacity of platforms to accept PSD/APG/RPSDs*
> b. *Feasibility & location for PSD/APG/RPSDs equipment room*
> c. *Confirmation of adequate power for PSD/APG/RPSDs*
> d. *Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> e. *Determination of communications requirements, availability and cost*
> f. *Determination of gap detection and entrapment avoidance technology requirements*
> g. *Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
   - Double the amount of motors as PSDs (each motor operating a single leaf).
   - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
   - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
   - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY. Status of doors will be provided to crew via indicator lights, with no automated propulsion cutout.

If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

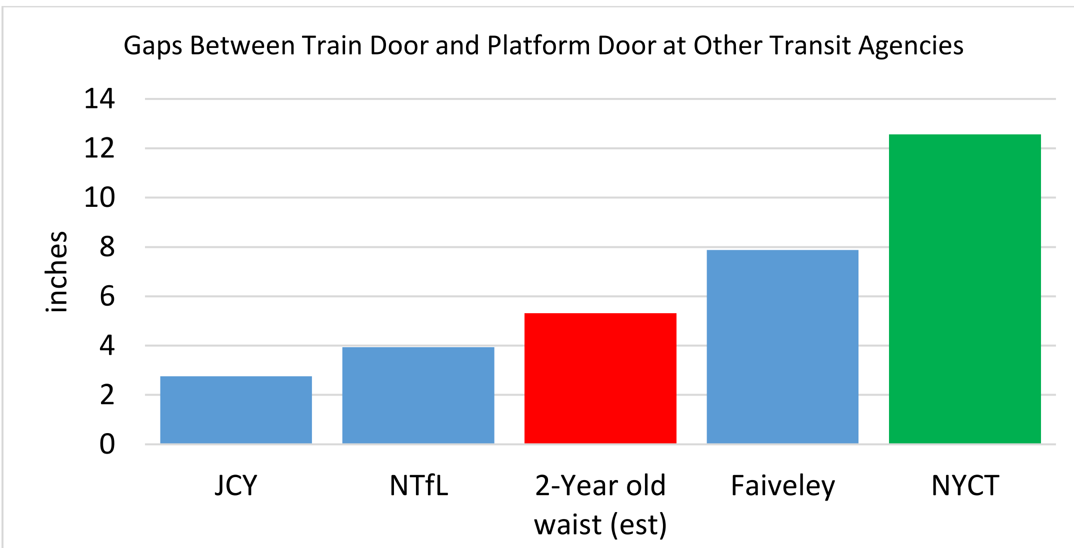


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

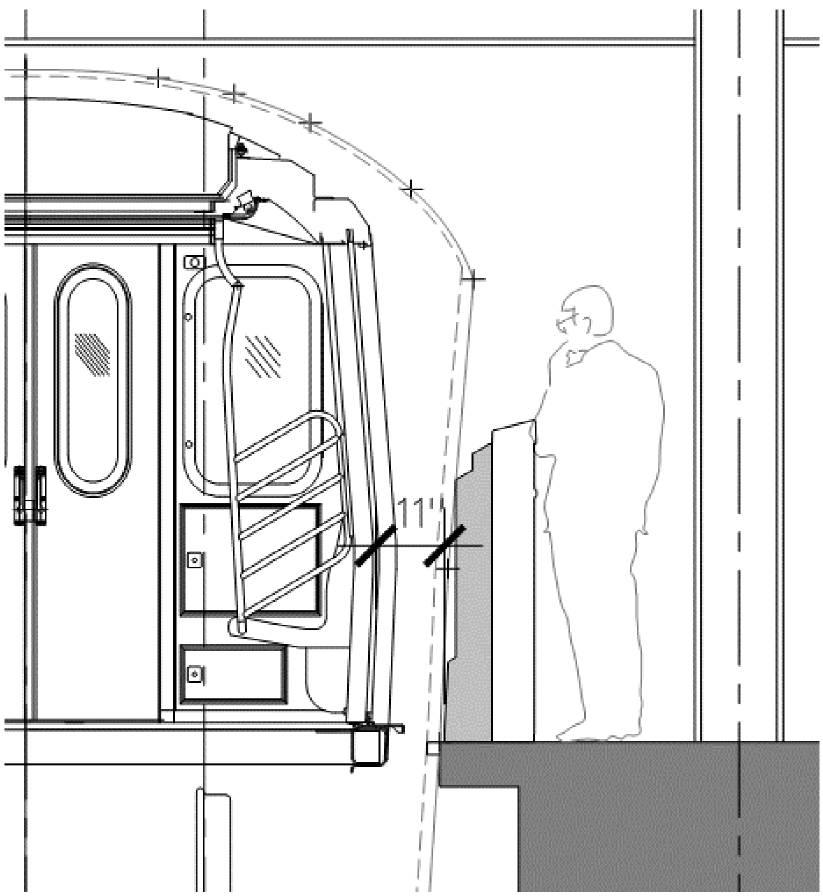


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber “bumpers” on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6” into the line equipment envelope. This would leave a 5” gap between the platform and car doors allowing approximately 2” of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5" by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor's window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor's window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **<u>bold/underline</u>**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the “ON” position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the ‘PSD Closed and Locked’ (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that ‘PSD Closed and Locked’ indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that ‘PSD Closed and Locked’ indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train’s removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	**PSD System 1**	**PSD System 2**	**PSD System 3**
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Station Capacity Analysis	**3rd Ave.**	**6th Ave.**	**14 St / Union Square**	**1st Ave.**
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are "existing" as defined by code. All the rolling stock is also to be considered "existing" under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60" radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36" of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

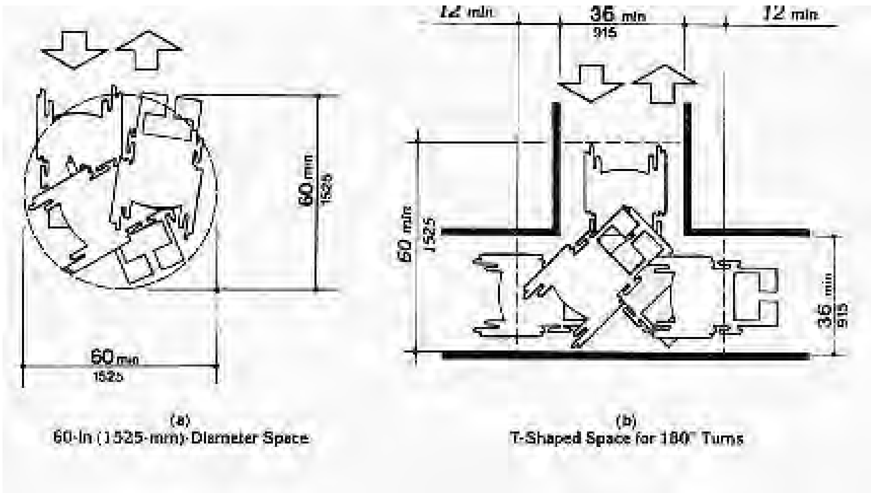
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

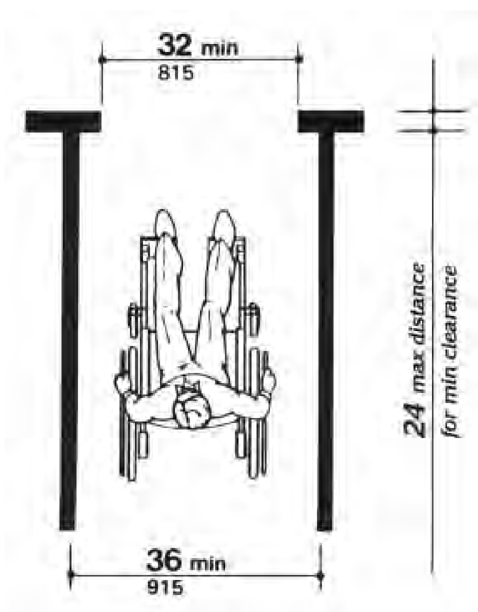


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

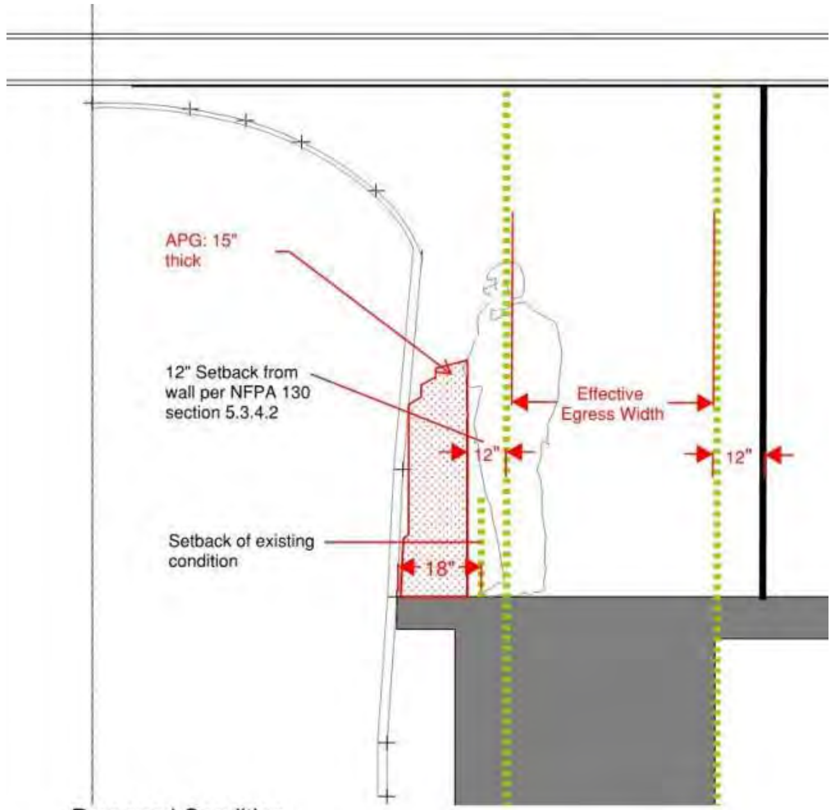
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15" of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

Berthing Report

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

Table of Contents

Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

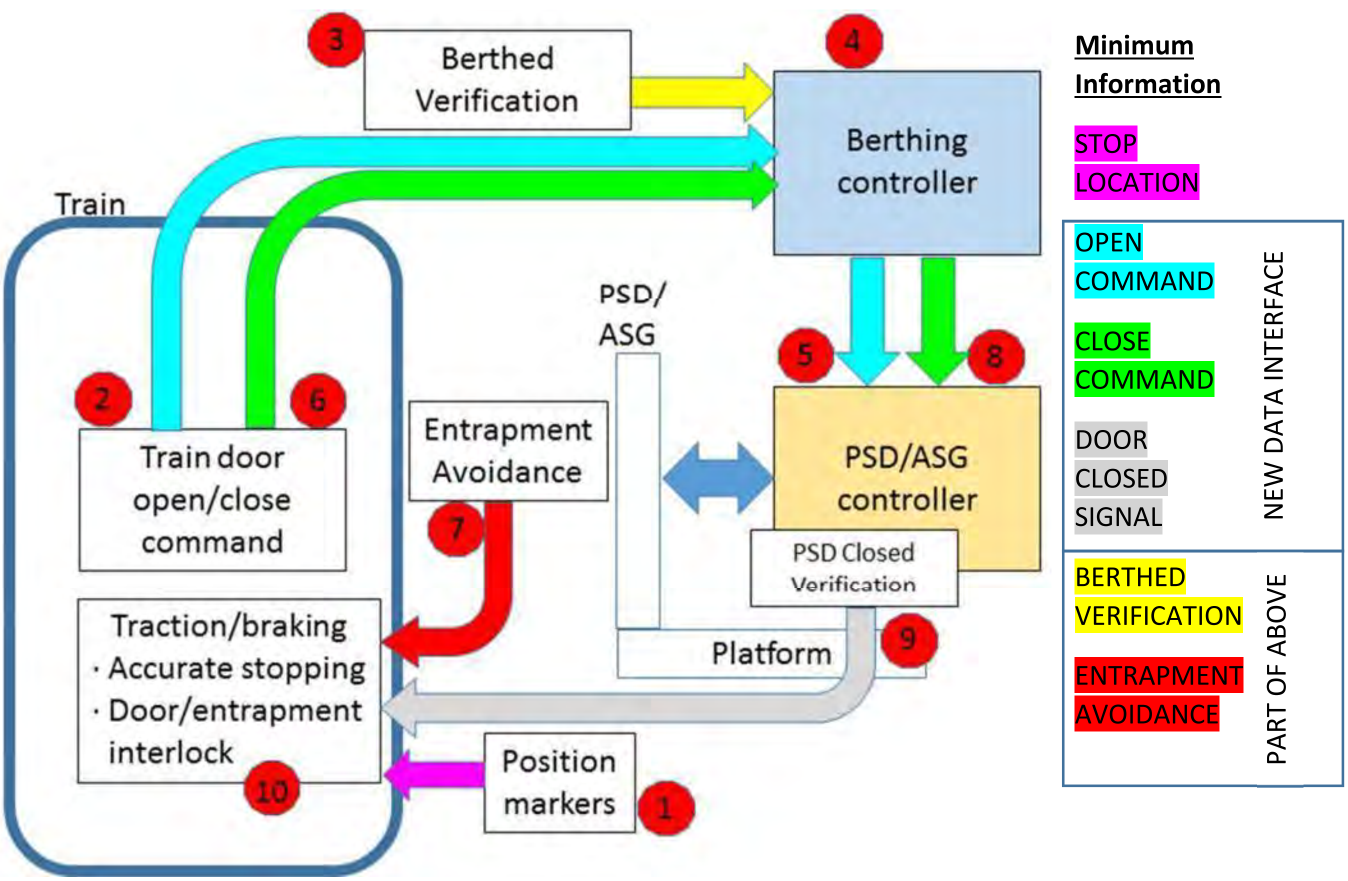
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

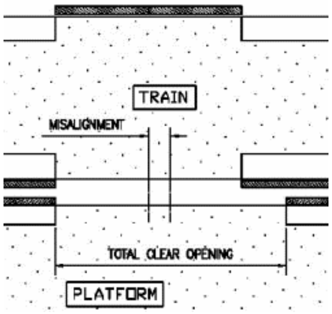
C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5” clear opening, a design for NY should meet the ADA Accessibility Guideline of 36”.

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a ‘distance totem’ which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy’s COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

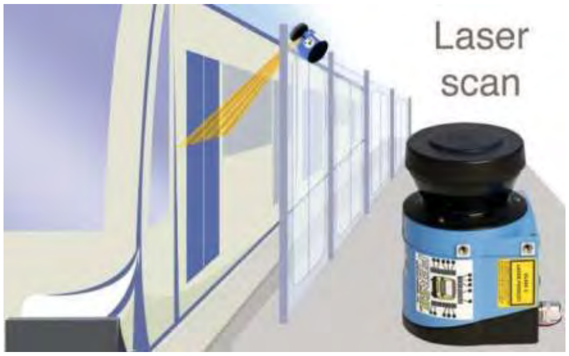
The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically

If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.



For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

End of Appendix

Appendix B – Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

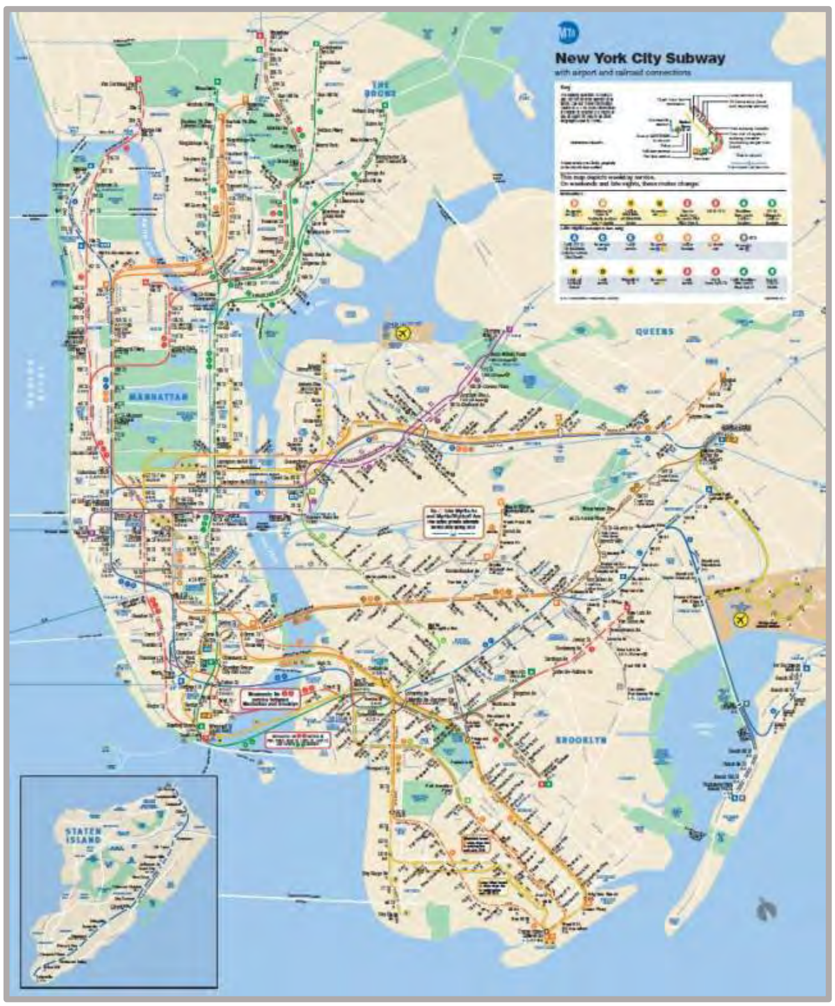


Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4’-0”). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

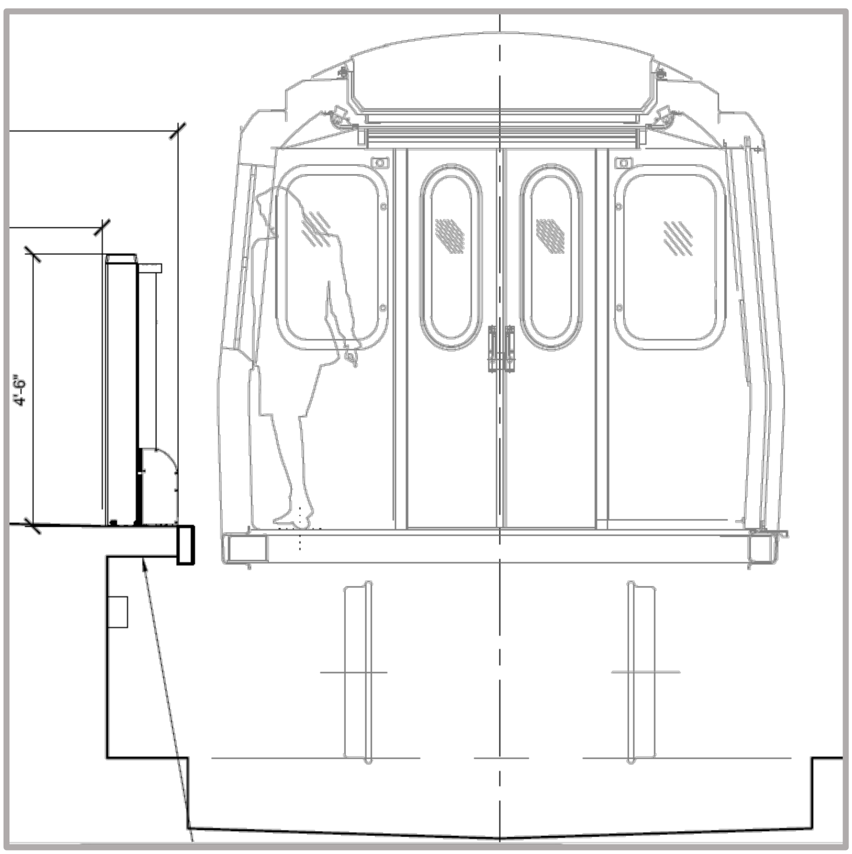


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 $lbs/ft.^2$ (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

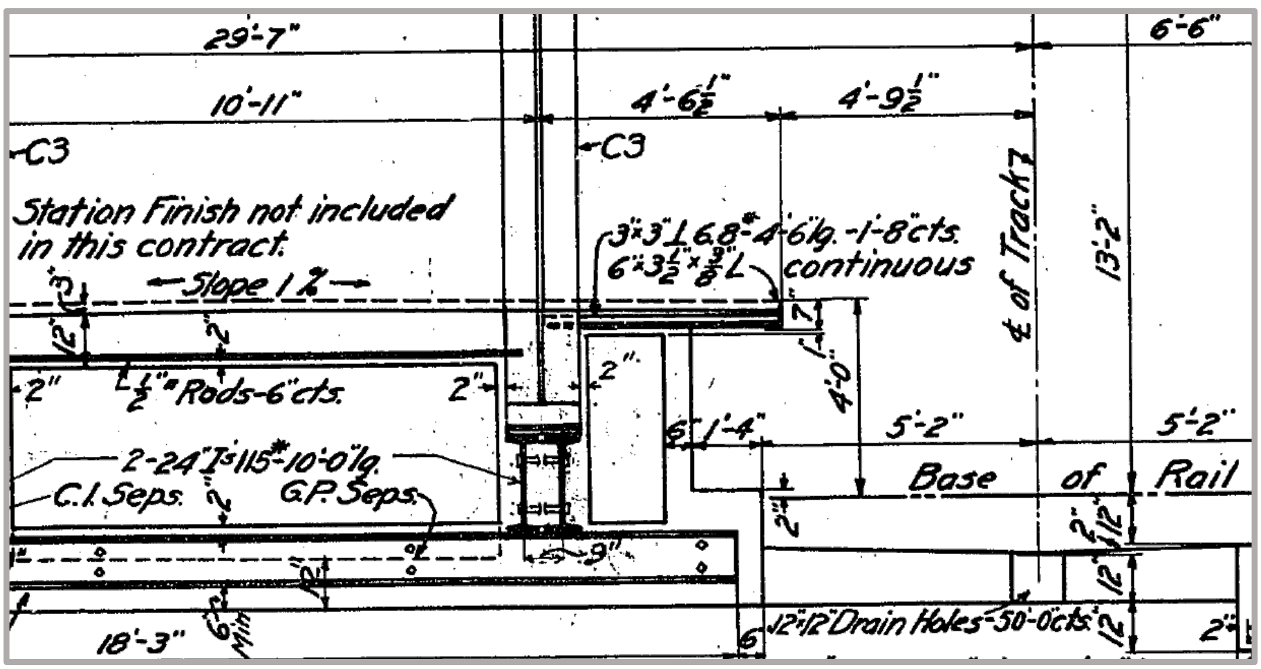


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

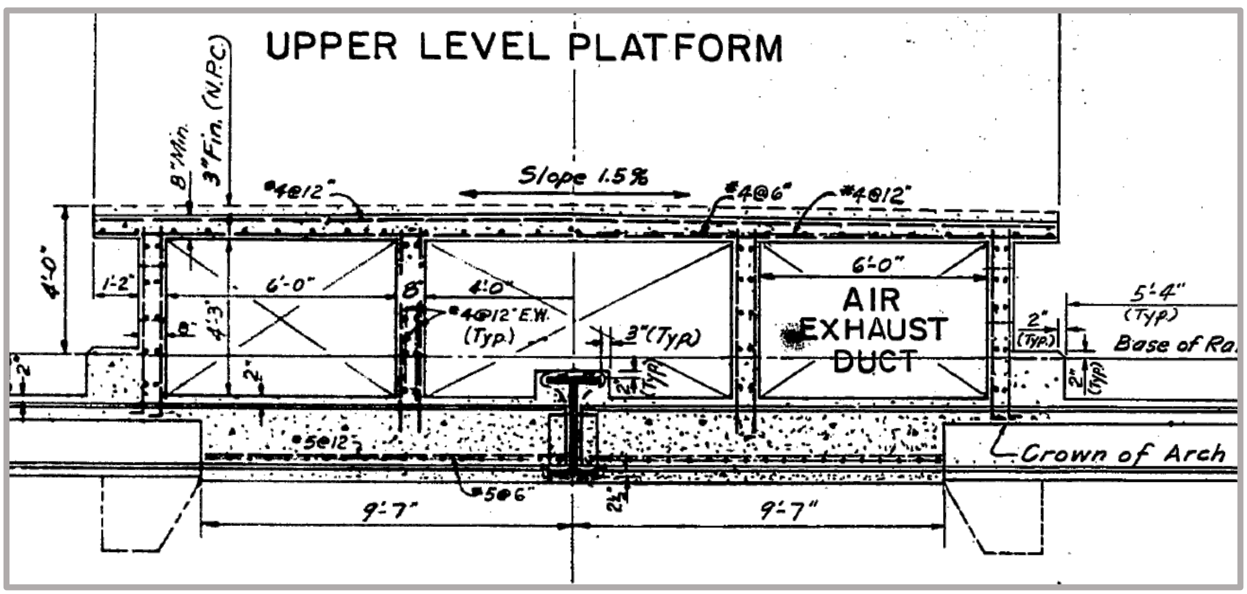


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

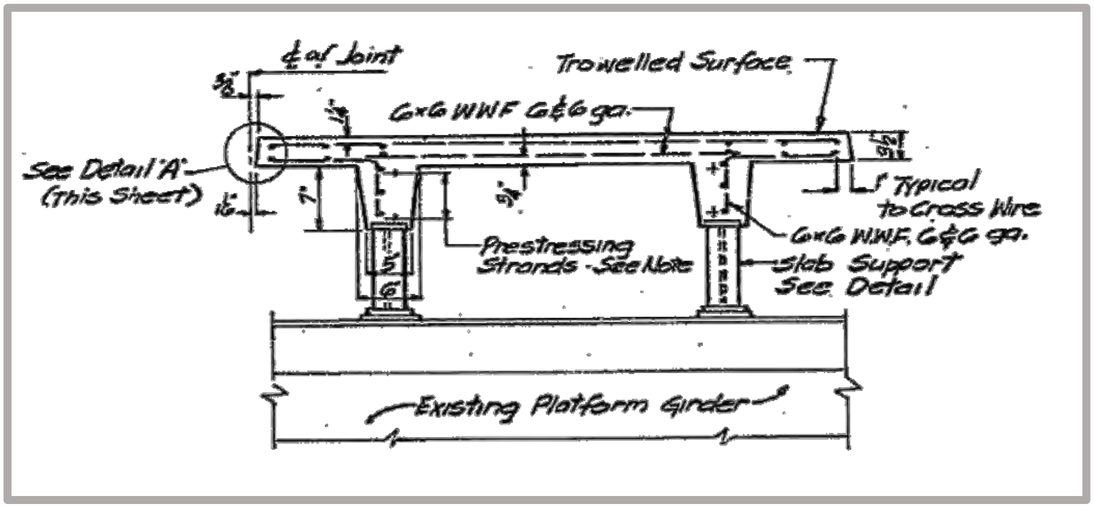


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

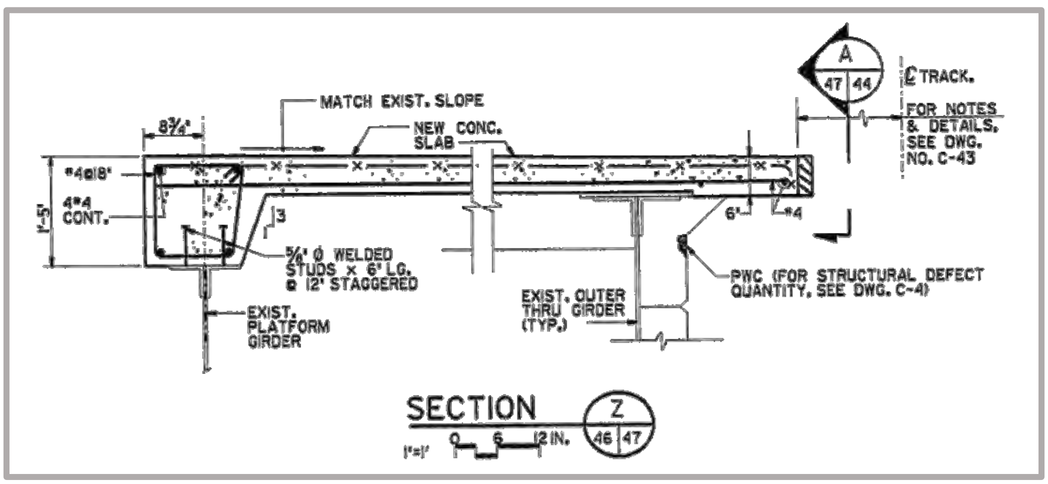


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2'-9"), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

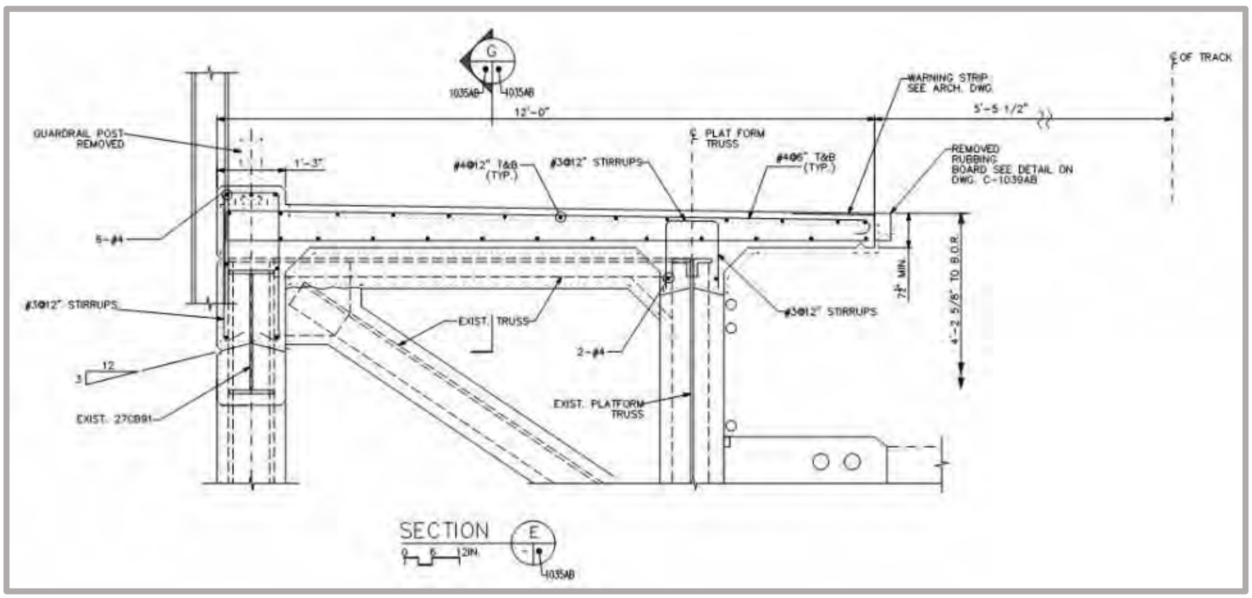


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3” thick structural slab with an approximately 3” thick topping slab. If the topping slab is fully removed, a 6” thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6” thick slab will be sufficient for a cantilever length of up to approximately 3’-0”, greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6” structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6” minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

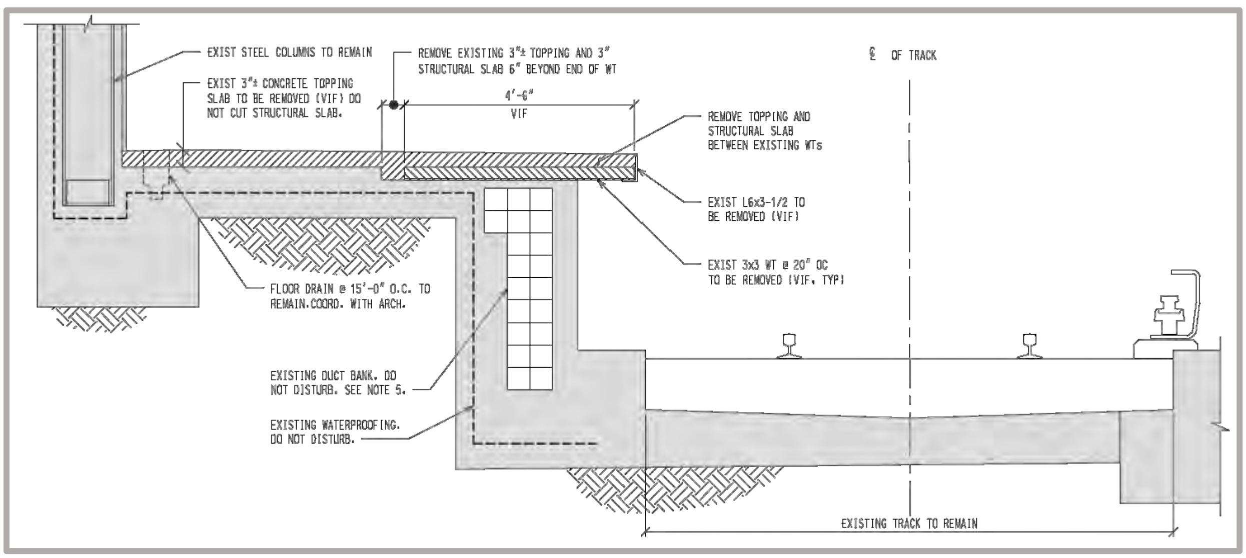


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

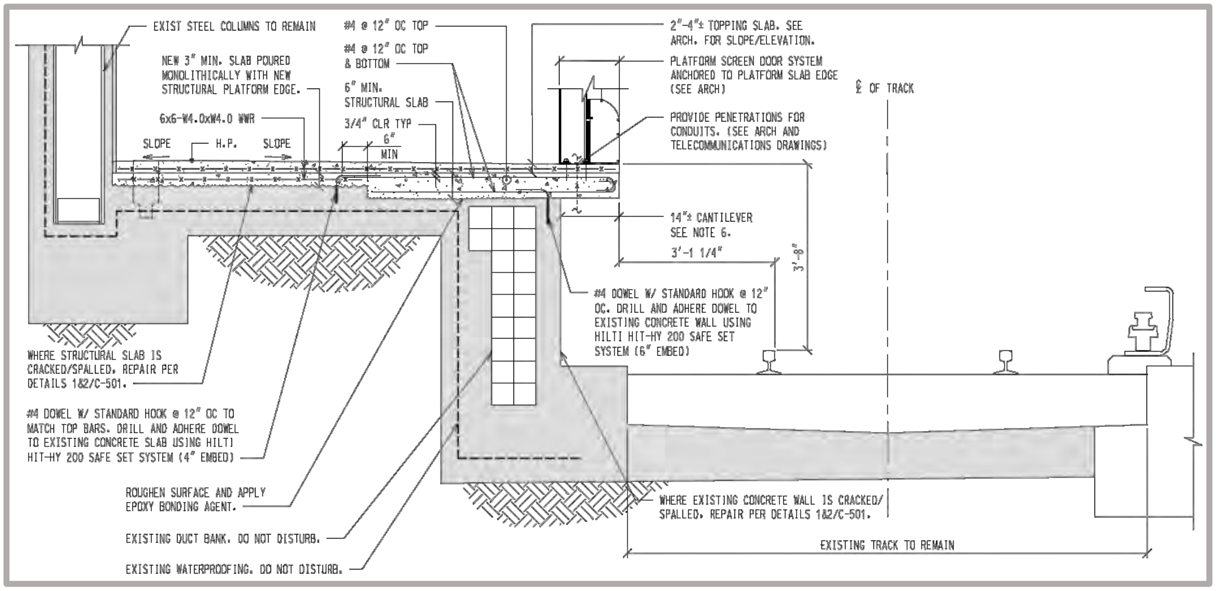


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

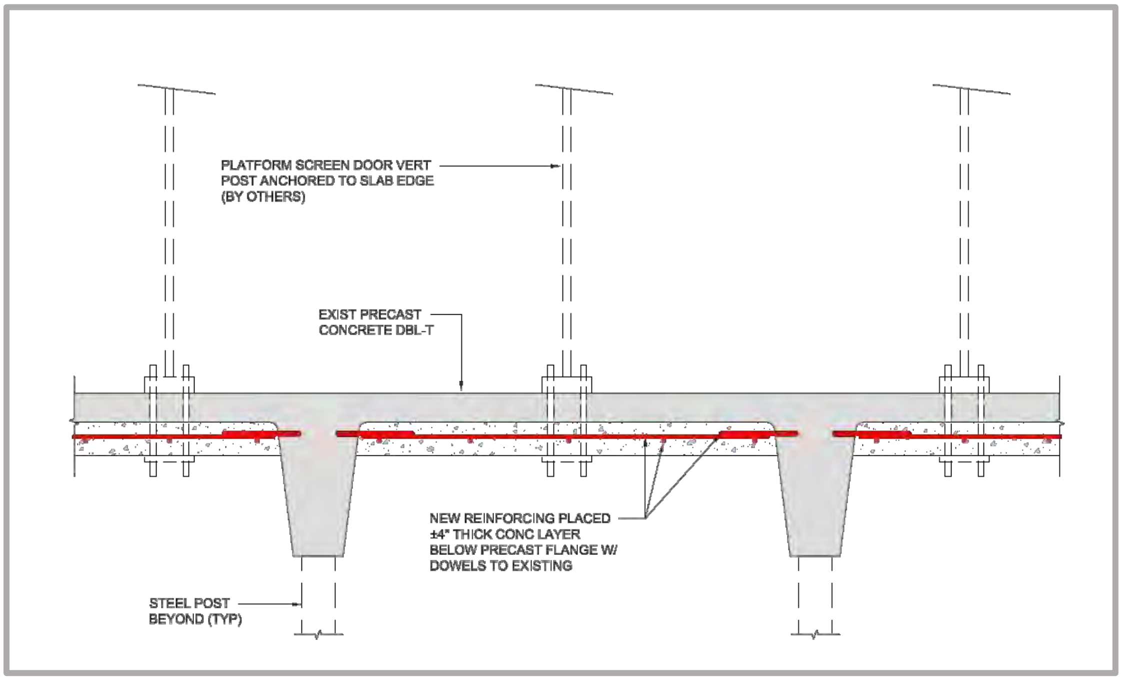


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C – Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5’ – 11” of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

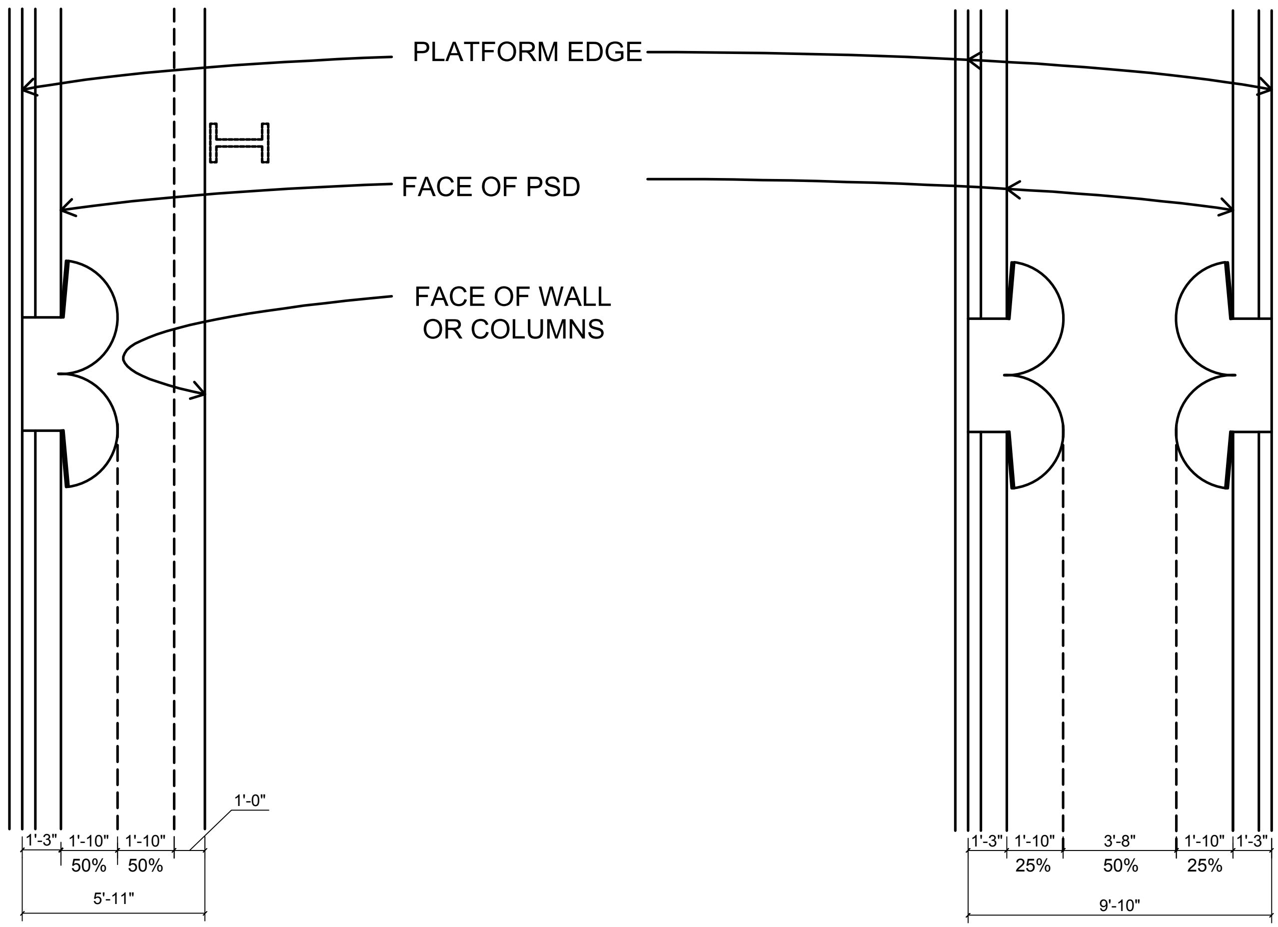


FIGURE 1 – SIDE PLATFORM

FIGURE 2 – CENTER PLATFORM

Appendix D: Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Manhattan

6.0 Station Descriptions

6.1 6th Avenue Station

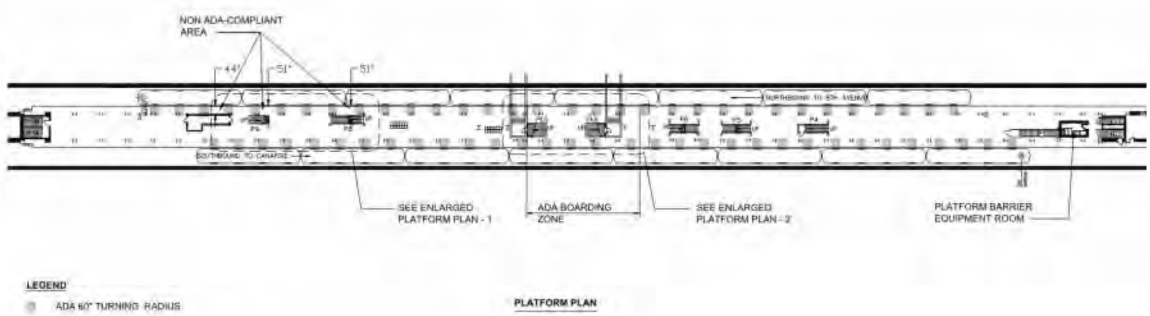


Figure 11 - Key Plan - 6th Avenue Station

Equipment Room

Space required for equipment room is available at the end of the platform.

Track Layout

Track is tangent. No excessive gaps are anticipated.

Platform edge condition

Existing conditions: Retrofitted fiber reinforced polymer panels laid on top of existing concrete cantilever; orange abrasive strip with likely asbestos content. The 2012 NYCT condition survey report gave the platform edges a rating of 4 and 4.5. Platform structural work will be required.

Platform obstructions within 5' of edge:

Brooklyn Bound: All columns are 41" from platform edge. One column is centered on the ADA - designated door; this obstruction can be remedied by moving the stopping location of the train.

8th Avenue Bound: All columns are 41" from platform edge; at the west end, stairs P-8 and P-9 sit 51" away from the platform edge for a length of 15' each. (see enlarged plan PSK-3.2). In addition, there is an ejector room which sits 44" from the platform edge for a length of 30'

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge. Not expected to be an issue if APGs are employed.

Ventilators:

Per the NYCT MOW drawings, ventilators are indicated over both tracks at the east and west end of the station. However, facilities have been added to the lower mezzanine which may block air flow to these ventilators

Power:

Power is adequate. (see power summary)

Historic Restrictions:

None

Conclusion:

6th Avenue Station is not an acceptable candidate for the installation of a pilot platform edge barrier due to the creation of a non-compliant ADA dimension preventing movement along the platform edge at stair P8. The installation would cause the following negative effects:

- On the Brooklyn bound side, the existing position of the aft ADA door in front of a column will be further constrained by the addition of the barrier. This can be remedied by moving the stopping location of the train.
- On the 8th Avenue bound side, the installation of the barrier will cause an existing pinch point of 41" to be reduced to 26" – less than an acceptable ADA clearance for movement along the platform. To remedy this would require relocation of stair P-8. Per the NYCT ADA Chief, (see ADA summary) the stair reconstruction would trigger mandatory installation of elevators to the street.

Appendix D - Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Manhattan
(3rd Avenue Station, 14th Street Station, 6th Avenue Station, and 1st Avenue Station)

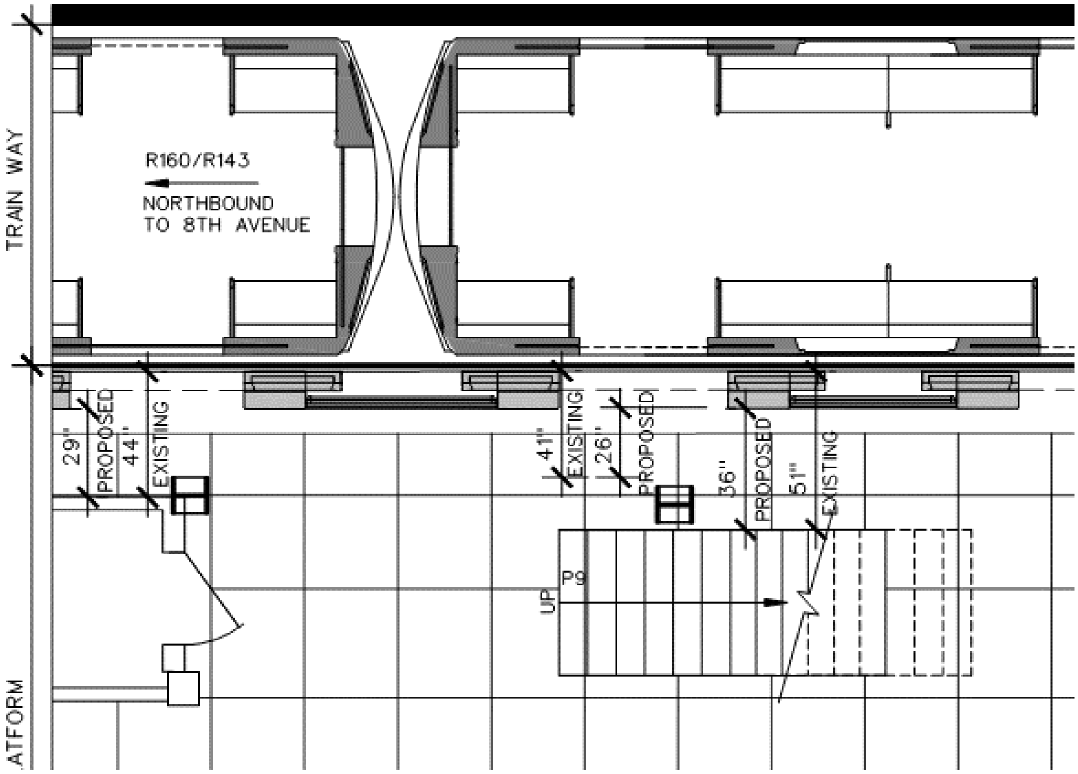


Figure 12 - Detail of clearances at 8th Ave-bound platform; see photo below – 6th Avenue Station

Figure 13 - Constrained space at 8th Ave-bound platform – 6th Avenue Station

6.2 14th Street Station / Union Square

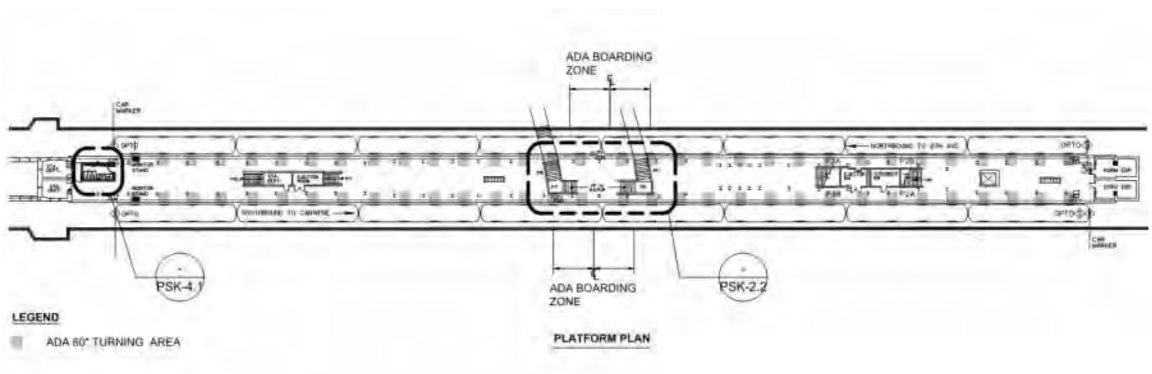


Figure 14; Key Plan – 14th Street / Union Square Station

Equipment Room

Space required for equipment room is available at the end of the platform.

Track Layout

Track is tangent. No excessive gaps are anticipated.

Platform edge condition

Existing conditions: Ceramic tactile tiles laid on top of reconstructed concrete cantilever with polyethylene rubbing board. The 2012 NYCT condition survey report gave the platform edges a rating of 2.5. Despite this good rating, platform structural work will likely be required to support the added load of the platform edge barrier.

Platform obstructions within 5' of edge:

Brooklyn Bound: column distance from platform edge varies; at east and west ends, columns are approximately 42" from platform edge; at center third of platform, columns are 30" from platform edge. Stairs P6 and P7 (to BMT Broadway line) effectively form a wall at 48" from the platform edge for a length of approximately 15'. Stair P6 is located at the ADA-designated door.

8th Avenue Bound: column distance from platform edge varies; at east and west ends, columns are approximately 42" from platform edge; at center third of platform, columns are 28" from platform. The stairs P6 and P7 mentioned above do not block movement on this side of the platform.

Lighting:

Existing lighting: Linear fluorescent in extruded aluminum housing, approximately 12" from platform edge. Not expected to be an issue if APGs are employed.

Ventilators:

Per the NYCT MOW drawings, no ventilators are present. However one set of ventilators was observed at the west end of the Brooklyn-bound track

Power:

Power is adequate. (see power summary)

Historic Restrictions:

14th Street/ Union Square station is on the National Historic Register. As such, any alteration will require review and approval by SHPO.

Conclusion:

14th St / Union Square Station is not an acceptable candidate for the installation of a pilot platform edge barrier due ADA code, historic restrictions, and construction coordination issues. The installation would cause the following negative effects:

- On the Brooklyn bound side, the existing position of the forward ADA door in front of stair P-6 currently has a 48" landing dimension between platform edge and wall. This non-compliant dimension will be worsened with the installation of the platform edge barrier which will bring the dimension down to 33". Efforts to remedy this by moving the stopping location will only bring other doors into non-compliance. The only possible solution would be to reconstruct the stair further away from the platform edge. However, another NYCT capital project currently in design (Planning No.ST01-7935), seeks to widen the stair due to crowding at the station.

- On the Brooklyn bound side, at the same stair P-6, there is an existing pinch point of only 30" between platform edge and column preventing ADA movement along the platform (32" min.). This situation will be worsened by the installation of the platform edge barriers which will reduce the dimension to 15". Not only is this non-compliant for ADA, it also is clearly non-compliant with respect to the building code. A possible alternative route features a 29" space – still less than the code minimum 32" for a doorway.
- This station is on the National Historic Register. This presents a risk factor for the expeditious advancement of the PSD project. While the probability of success is better than 50%, there could be numerous delays during the review process, and SHPO may require alterations to the design.
- The concurrent project mentioned in the first bullet (Planning No.ST01-7935) proposes to reconstruct two platform stairs and install an escalator at the center of the platform. This presents a risk factor in that two contractors will be competing for space on the platform, and both will be under the same schedule restrictions requiring completion when the river tunnel reopens.

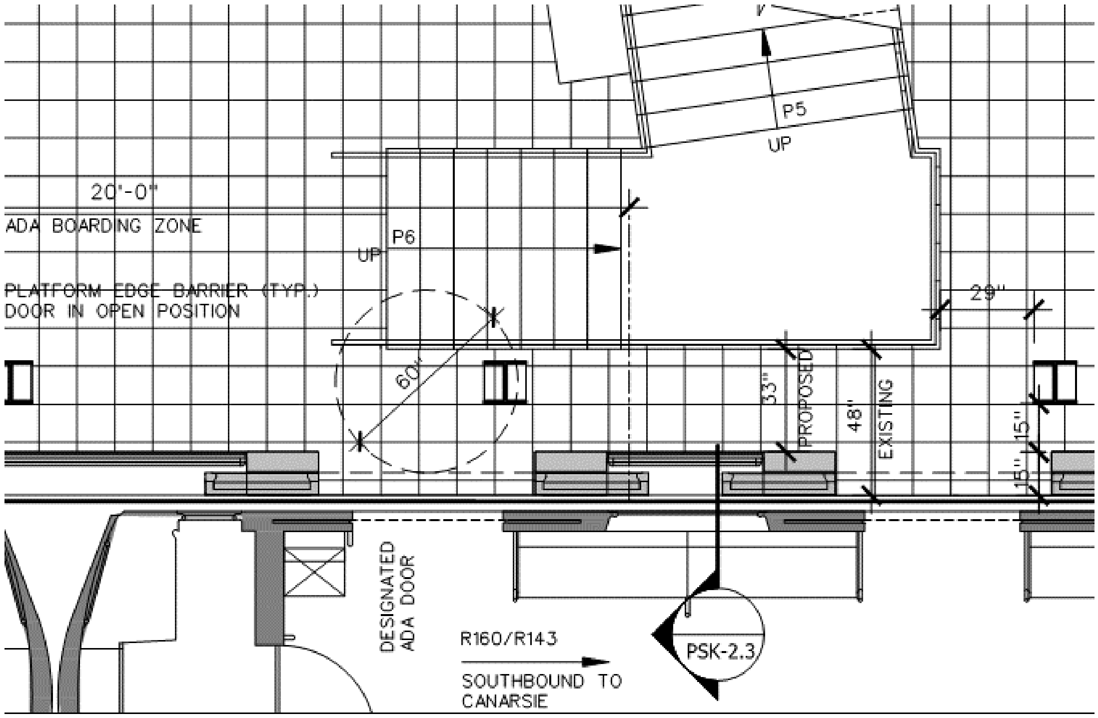


Figure 15 - Plan detail at stair P-6 showing reduction in clearances; see photos on following page

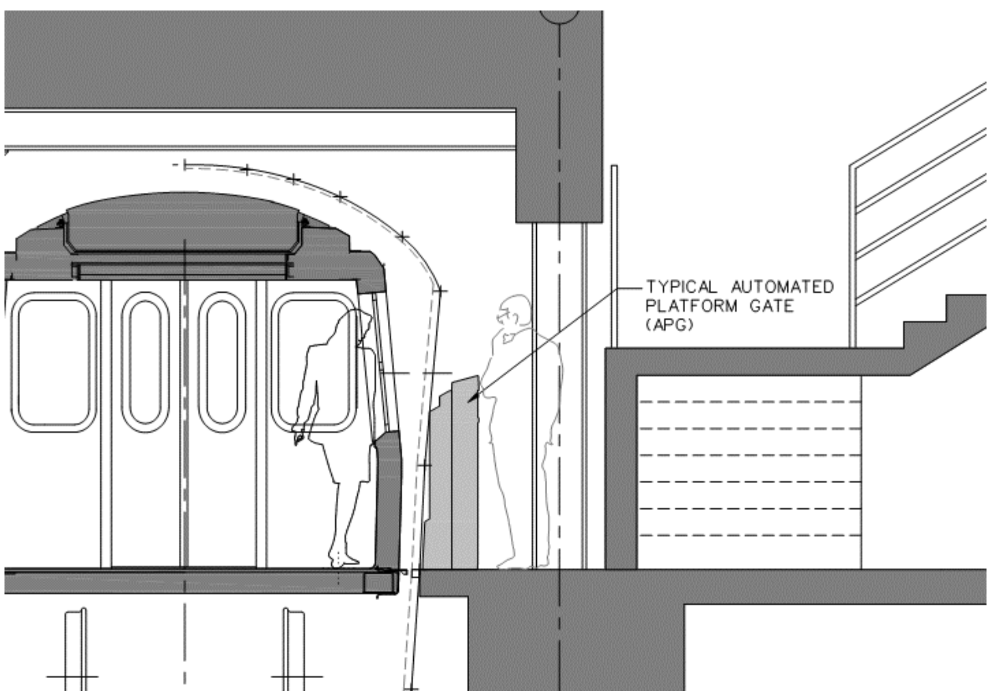


Figure 16 - Section at stair P-6, P-7 at Brooklyn-bound platform – 14th St / Union Square Station

Figure 17 - Brooklyn-bound platform at stair P-6 showing ADA train door – Union Square Station

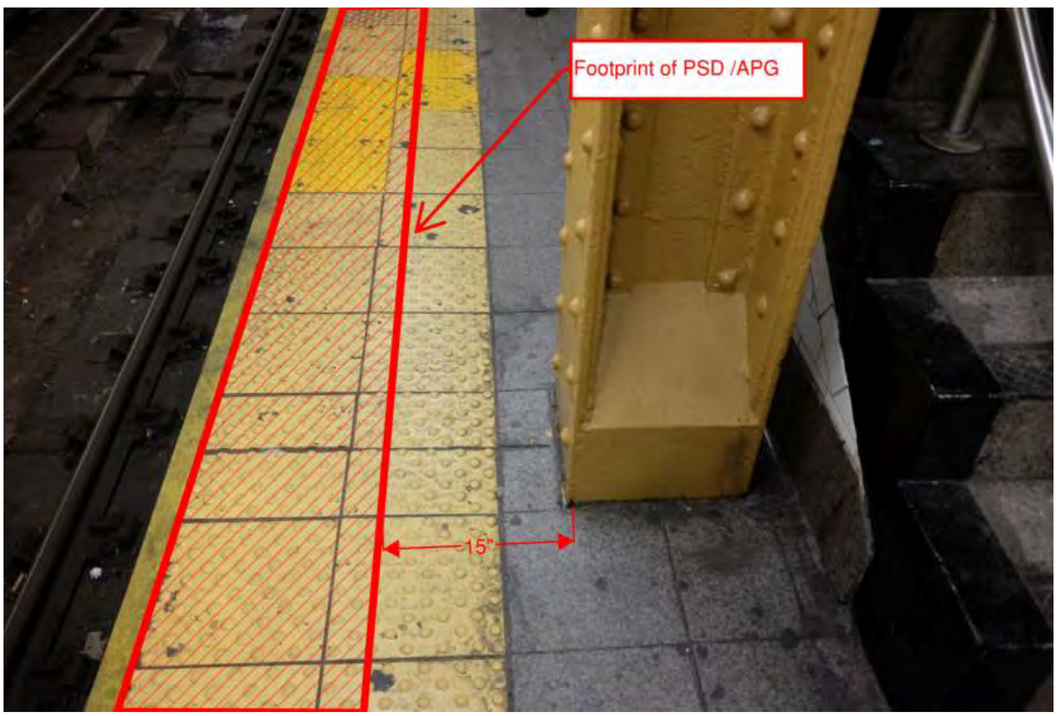


Figure 18 - Brooklyn-bound platform at stair P-7 – Union Square Station

6.3 3rd Avenue Station

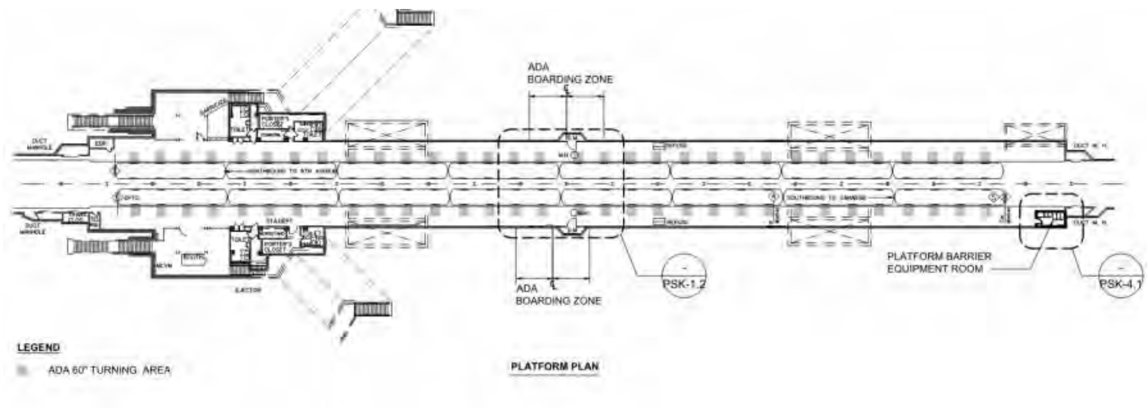


Figure 19 - Key Plan – 3rd Avenue Station

Equipment Room

Space required for equipment room is available at the end of the platform.

Track Layout

Track is tangent. No excessive gaps are anticipated.

Platform edge condition

Existing conditions: Retrofitted fiber reinforced polymer panels laid on top of existing concrete cantilever; orange abrasive strip with likely asbestos content. The 2012 NYCT condition survey report gave the platform edges a rating of 3.5. Platform structural work will be required.

Platform obstructions within 5' of edge:

Brooklyn Bound: no columns; no obstructions

8th Avenue Bound: no columns; no obstructions

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge. Not expected to be an issue if APGs are employed.

Ventilators:

Per the NYCT MOW drawings, two sets of ventilators are indicated over each platform.

Power:

Power is adequate. (see power summary)

Historic Restrictions:

None

Conclusion:

Due to the absence of platform columns or other obstructions, the 3rd Avenue Station is a good candidate for the pilot installation of platform barriers. The platform edge is tangent and plumb and the nearest obstruction (the platform wall) is 8'-9" away (in built condition). Furthermore, due to the light usage of the station, the risk factor of mechanical failure has a much lesser consequence than at the other two stations.

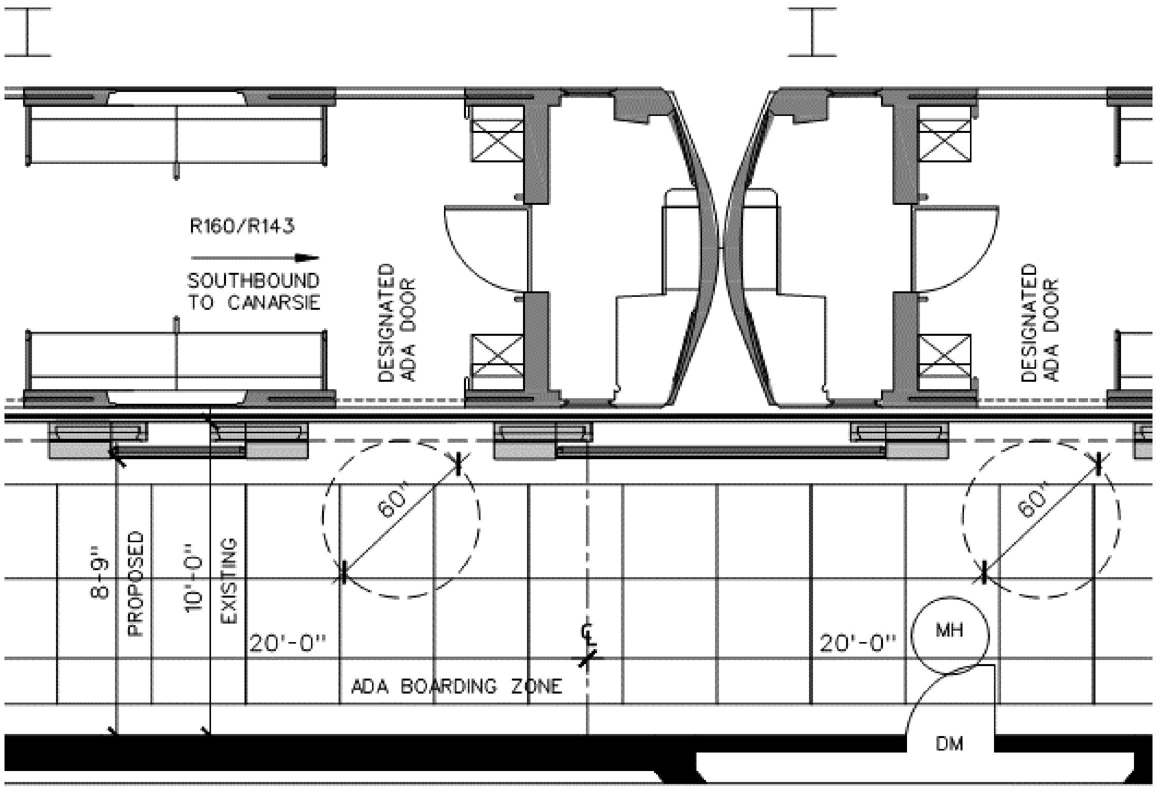


Figure 20 - Plan detail - 3rd Ave platform

Figure 21 - 3rd Avenue Platform

6.4 1st Avenue Station

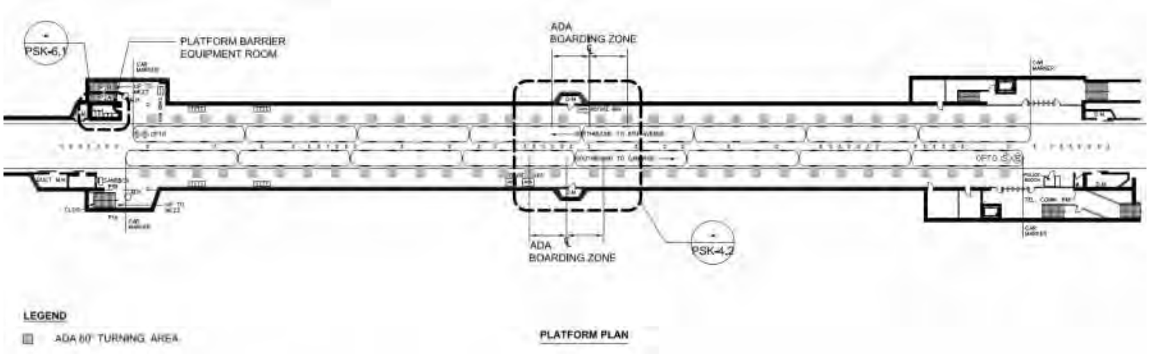


Figure 22 - Key Plan – 1st Avenue Station

Equipment Room

Space required for equipment room is potentially available at the end of the platform. However, the design of the First Avenue Station Rehabilitation (P-36437) indicates use of the abandoned EDR's as refuse rooms. There is no other readily available space for the equipment room.

Existing EDR-R room is to be decommissioned upon completion of contract P-36437. It will be required to make the room larger as necessary. However, per NYCT, existing EDR-R room will not be available until mid 2020.

Track Layout

Track is tangent. No excessive gaps are anticipated.

Platform edge condition

Existing conditions: Retrofitted fiber reinforced polymer panels laid on top of existing concrete cantilever; orange abrasive strip with likely asbestos content. The 2012 NYCT condition survey report gave the platform edges a rating of 3.0 for northbound and a rating of 3.5 for Southbound. Platform structural work will be required on both platforms to support the added load of the platform edge barrier.

Platform obstructions within 5' of edge:

Brooklyn Bound: no columns; no obstructions

8th Avenue Bound: no columns; no obstructions

Lighting:

Existing lighting: Linear fluorescent; approximately 24" from platform edge. Not expected to be an issue if APGs are employed.

Ventilators:

Per site observation by STV, two sets of ventilators are present over Brooklyn bound platform. And three sets of ventilators are present over 8th Avenue bound platform.

Power:

The proposed new electrical 800 amp service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward. See power summary.

Historic Restrictions:

None

Conclusion:

Although 1st Avenue Station has no platform columns or other obstructions, it is not a recommended candidate for the installation of a pilot platform edge barrier. There are three primary reasons for this finding:

- Scheduling of contract P-36437 (First Ave. Rehab) indicates availability of the equipment room space in mid-2020. Therefore, installation of the equipment room will not be feasible until the completion and re-opening of the Canarsie tunnel project.
- In addition to the above constraint, installation of the platform doors will need to occur after major construction of the tunnel project, since the First Avenue station is the entry point for all construction materials. This will necessarily extend the timeline of closure for the Canarsie line.
- Electrical power upgrade will need to be altered to a higher capacity in order to accommodate PSD.

Appendix D - Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Manhattan

(3rd Avenue Station, 14th Street Station, 6th Avenue Station, and 1st Avenue Station)

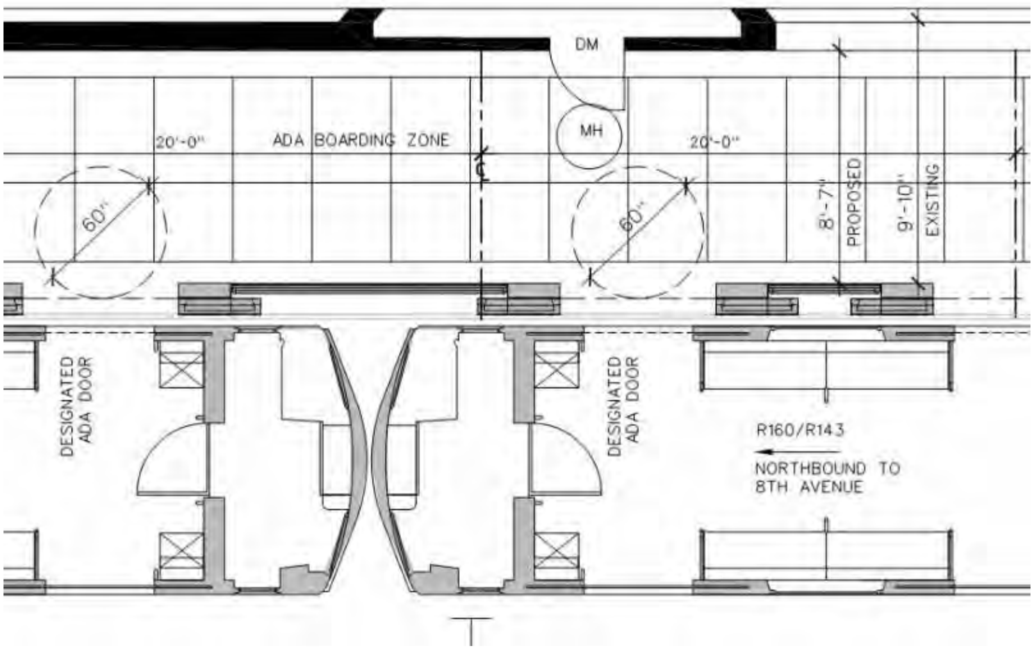


Figure 23 - Plan detail – 1st Ave platform

Figure 24 – 1st Avenue Platform

7.0 Appendix

7.1 Station Drawings

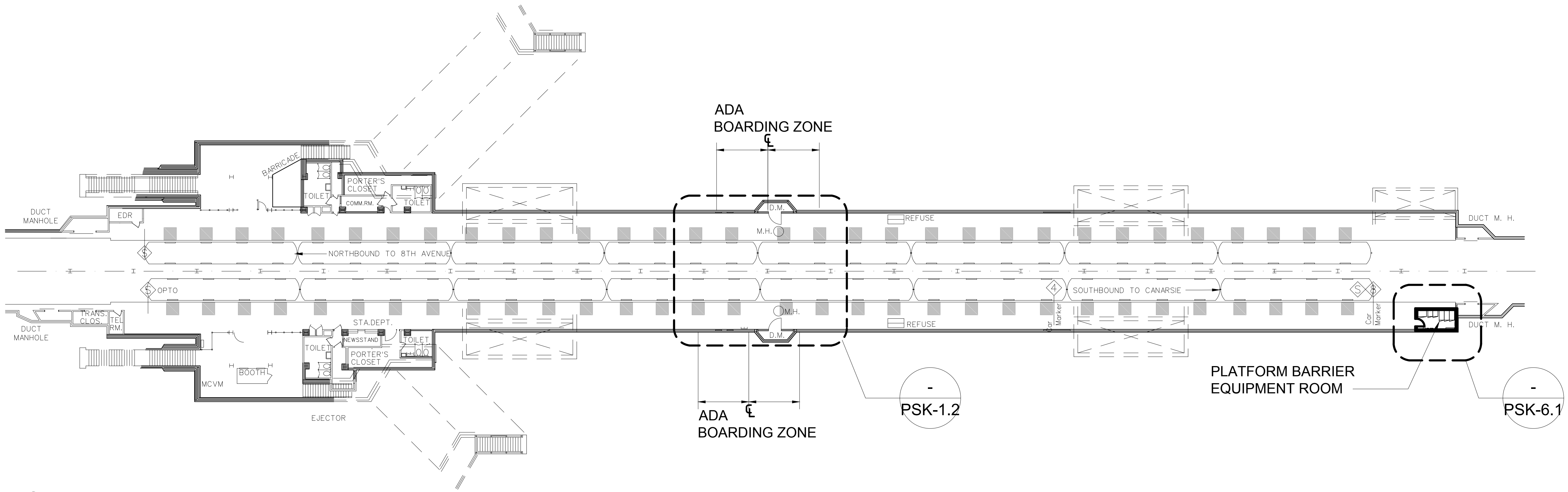
7.2 Cost Estimate

7.3 Projection for Annual Maintenance Costs

Removed from this appendix, see appendix F for Estimated Maintenance Costs

7.4 Berthing Report

7.1 Station Drawings



LEGEND

ADA 60" TURNING AREA

PLATFORM PLAN

PSK - 1.1 - 3RD AVENUE STATION OVERALL PLAN

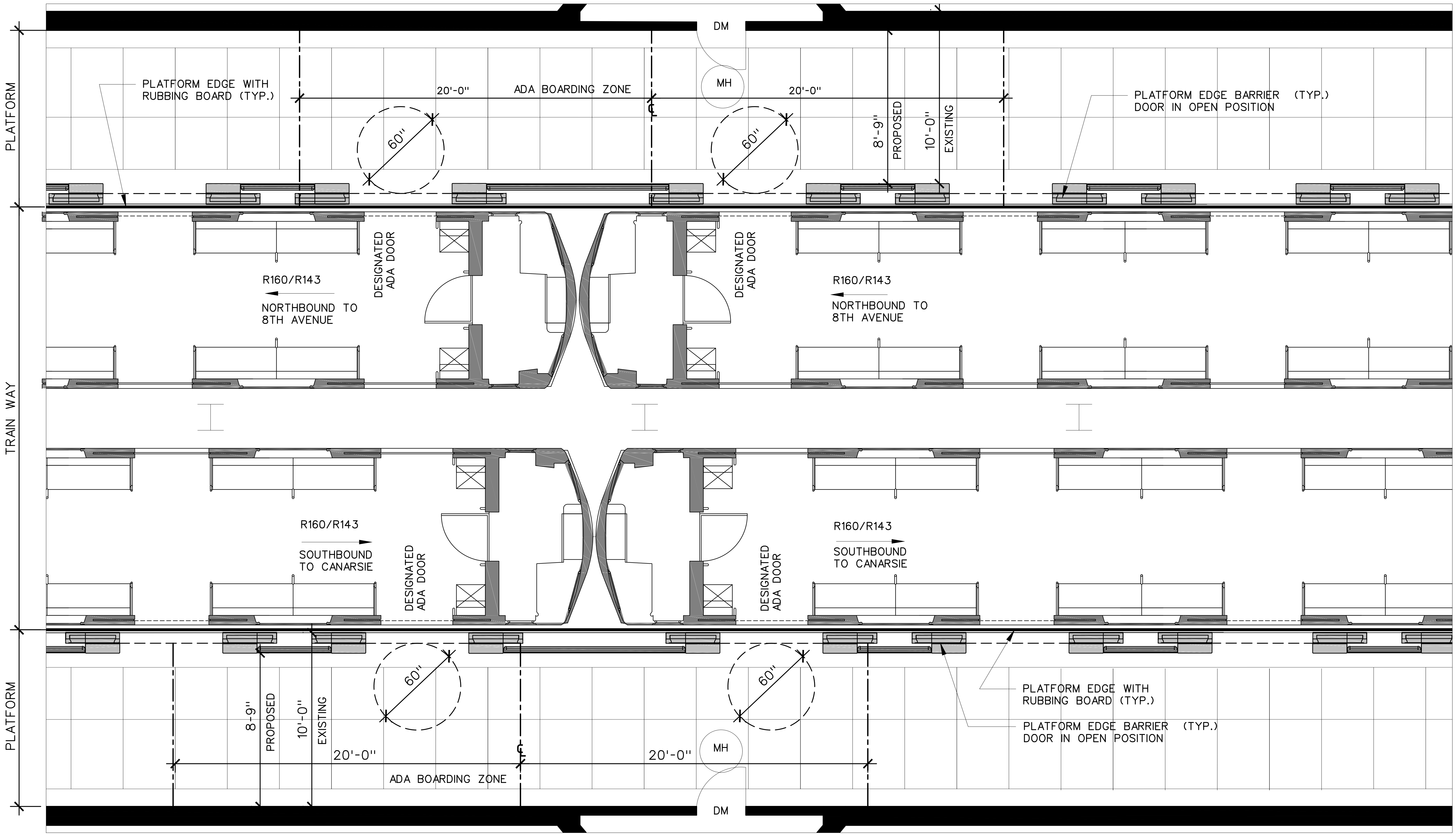
CANARSIE LINE - PLATFORM BARRIERS - ADA CLEARANCES & RESTRICTIONS ALONG PLATFORM EDGE

SEPTEMBER 15, 2017

0 50' 100'

MTA New York City Transit

STV 100 Years



PSK 1.2 - 3RD AVENUE STATION ENLARGED PLAN AT ADA BOARDING AREA

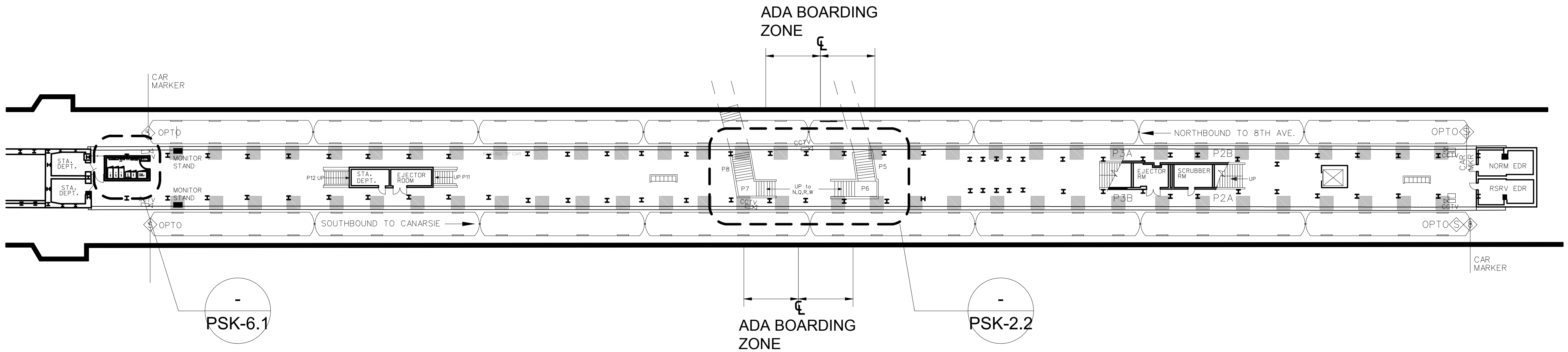
DETAIL FOR PLATFORM BARRIER CLEARANCES ALONG PLATFORM EDGE

0 24" 48" 96"

JULY 19, 2017

MTA New York City Transit

STV 100 Years



LEGEND

ADA 60" TURNING AREA

PLATFORM PLAN

PSK - 2.1 - 14TH ST - UNION SQUARE STATION OVERALL PLAN

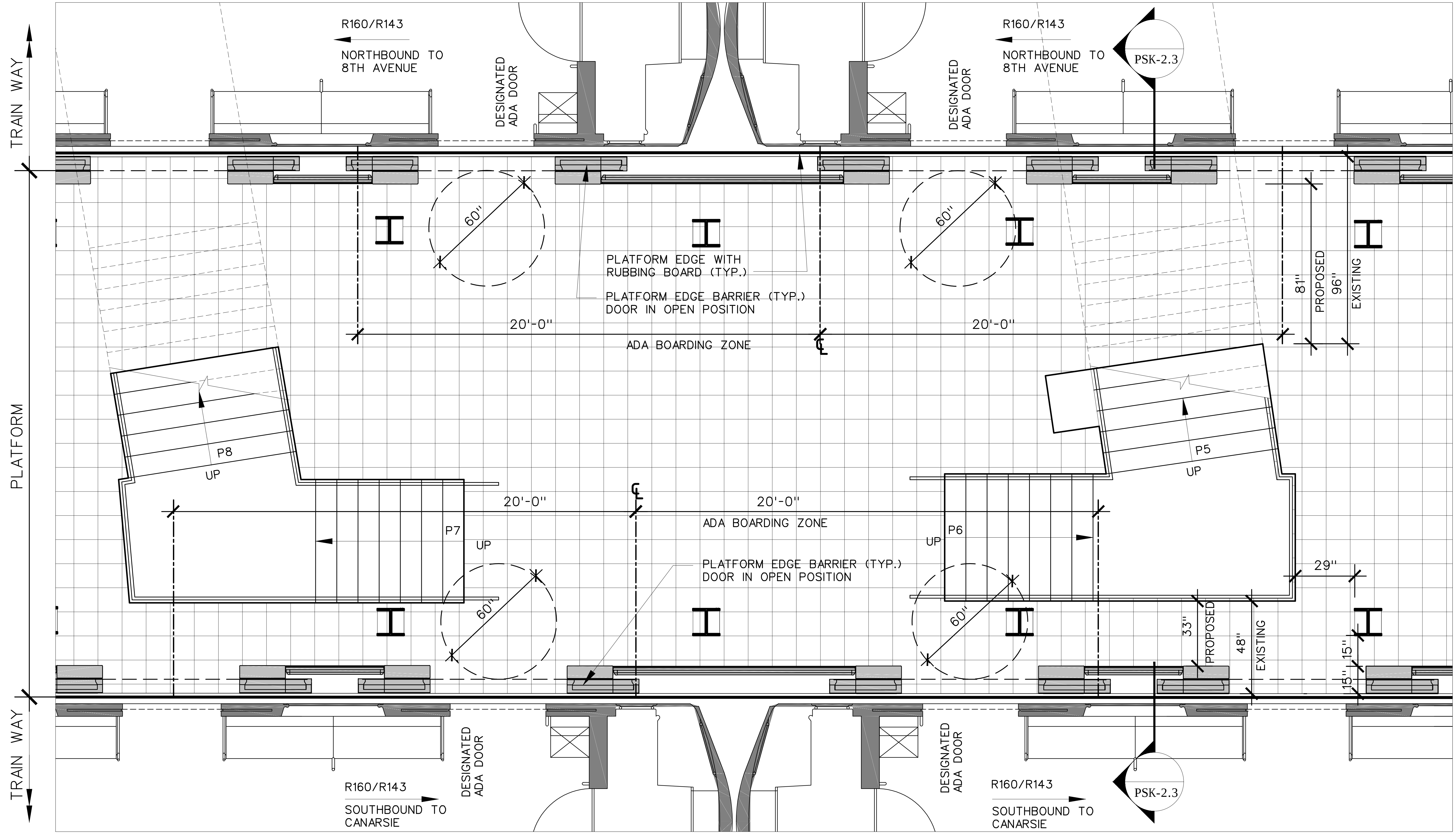
CANARSIE LINE - PLATFORM BARRIER - ADA CLEARANCES & RESTRICTIONS ALONG PLATFORM EDGE

SEPTEMBER 15, 2017

0 50' 100'

MTA New York City Transit

STV 100 Years



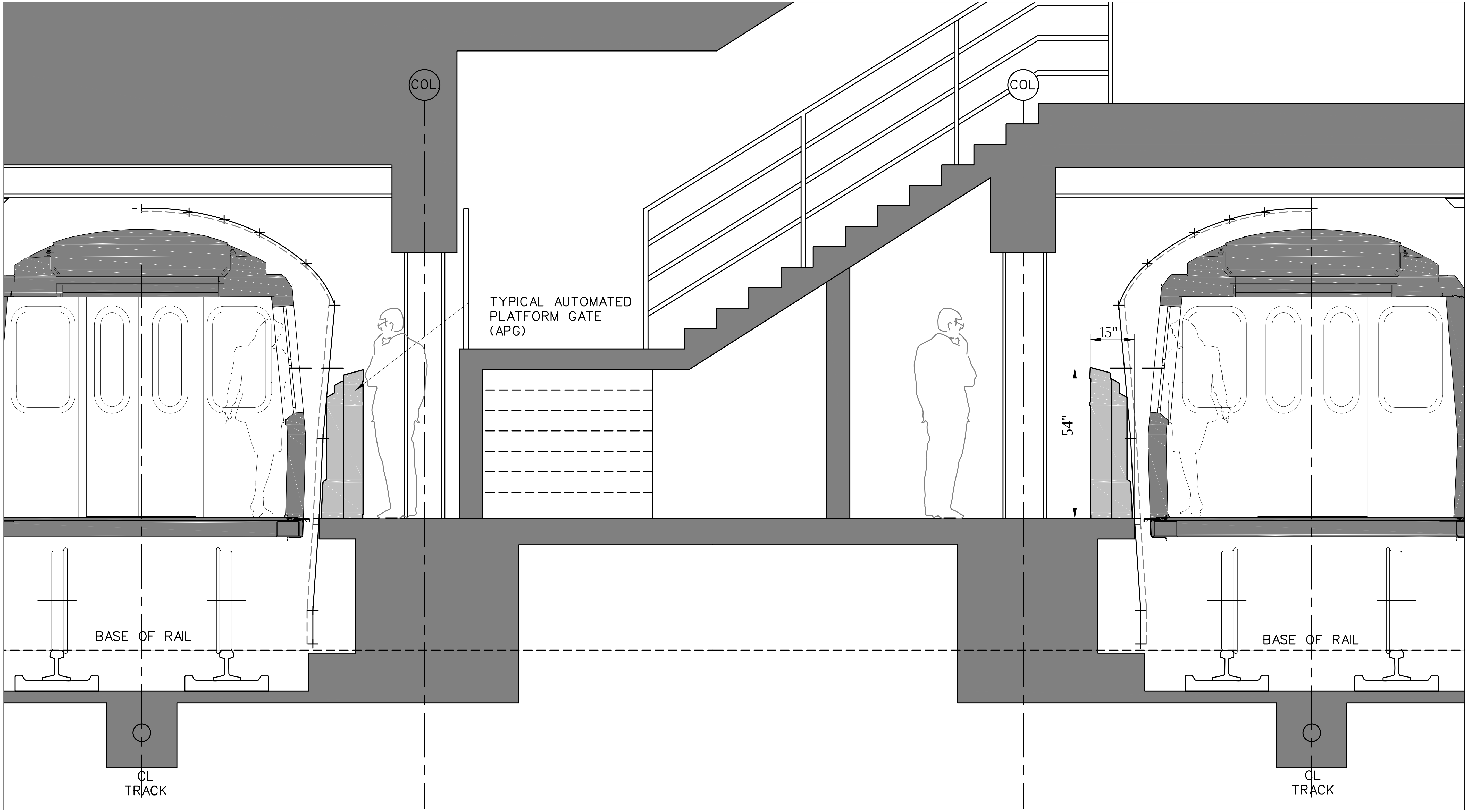
PSK - 2.2 - 14TH ST - UNION SQUARE STATION ENLARGED PLAN AT ADA BOARDING AREA

DETAIL FOR PLATFORM BARRIER CLEARANCES ALONG PLATFORM EDGE

JULY 19, 2017

MTA New York City Transit

STV 100 Years



PSK - 2.3 - 14TH ST - UNION SQUARE STATION CROSS SECTION

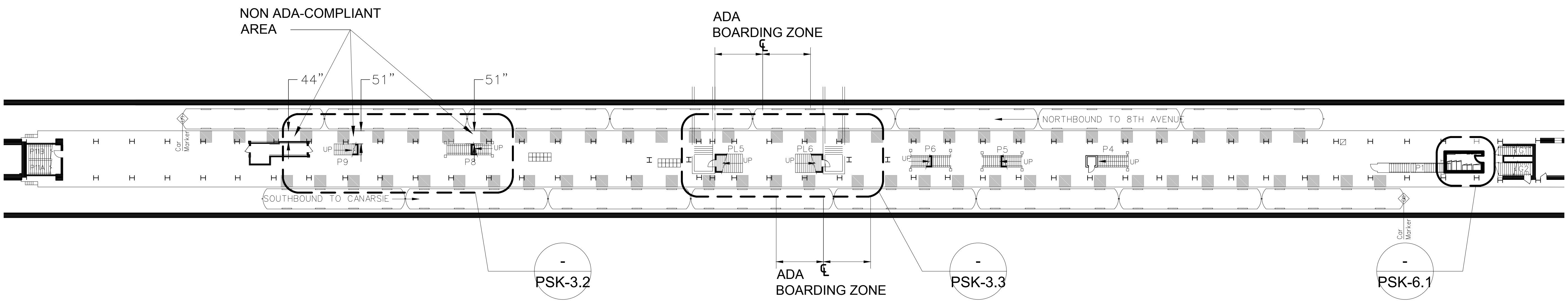
DETAIL FOR PLATFORM BARRIER CLEARANCES ALONG PLATFORM EDGE

0 12" 24" 48"

JULY 19, 2017

MTA New York City Transit

STV 100 Years



LEGEND

ADA 60" TURNING AREA

PLATFORM PLAN

PSK - 3.1 - 6TH AVENUE STATION OVERALL PLAN

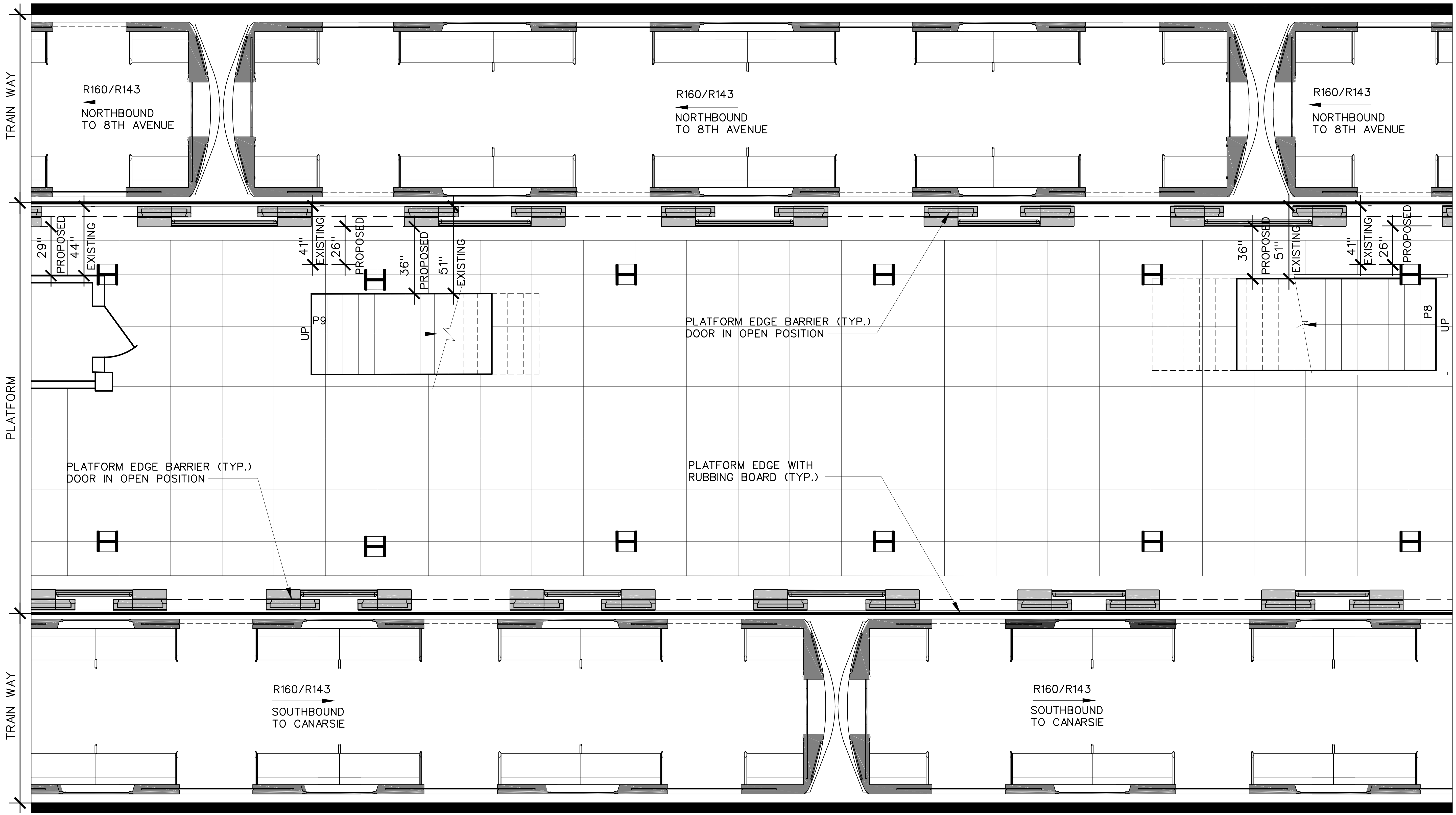
CANARSIE LINE - PLATFORM BARRIER - ADA CLEARANCES & RESTRICTIONS ALONG PLATFORM EDGE

SEPTEMBER 15, 2017

0 50' 100'

MTA New York City Transit

STV 100 Years



PSK - 3.2 - 6TH AVENUE STATION ENLARGED PLAN

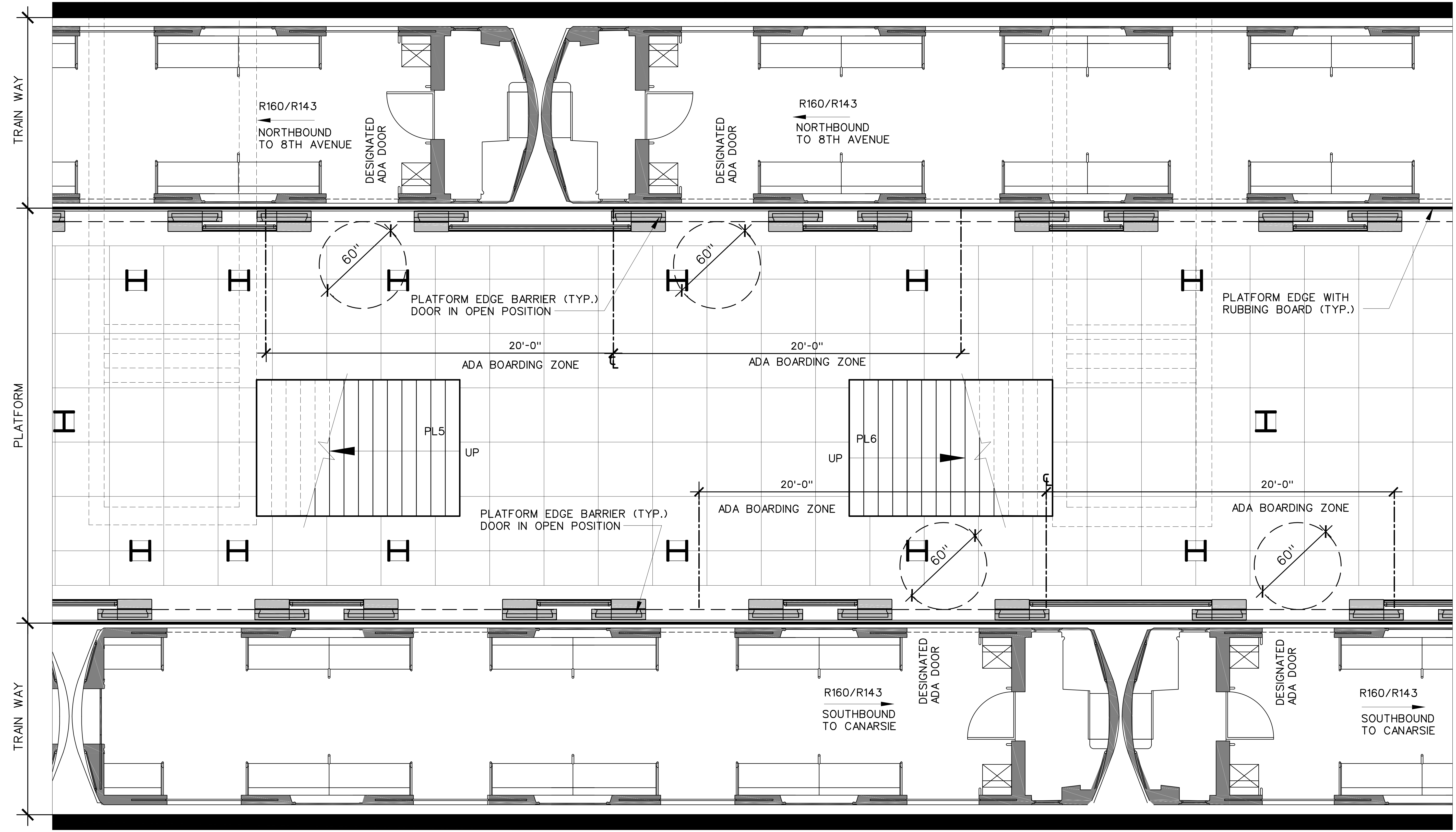
DETAIL FOR PLATFORM BARRIER CLEARANCES ALONG PLATFORM EDGE

0 24" 48" 96"

JULY 19, 2017

MTA New York City Transit

STV 100 Years



PSK - 3.3 - 6TH AVENUE STATION ENLARGED PLAN

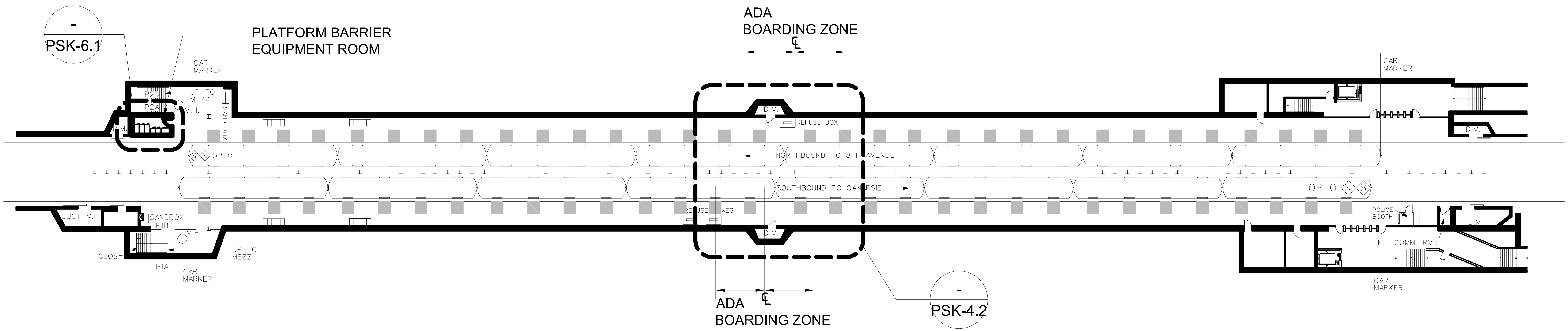
DETAIL FOR PLATFORM BARRIER CLEARANCES ALONG PLATFORM EDGE - 2

0 24" 48" 96"

JULY 19, 2017

New York City Transit

STV 100 Years



LEGEND

ADA 60" TURNING AREA

PLATFORM PLAN

PSK - 4.1 - 1ST AVENUE STATION OVERALL PLAN

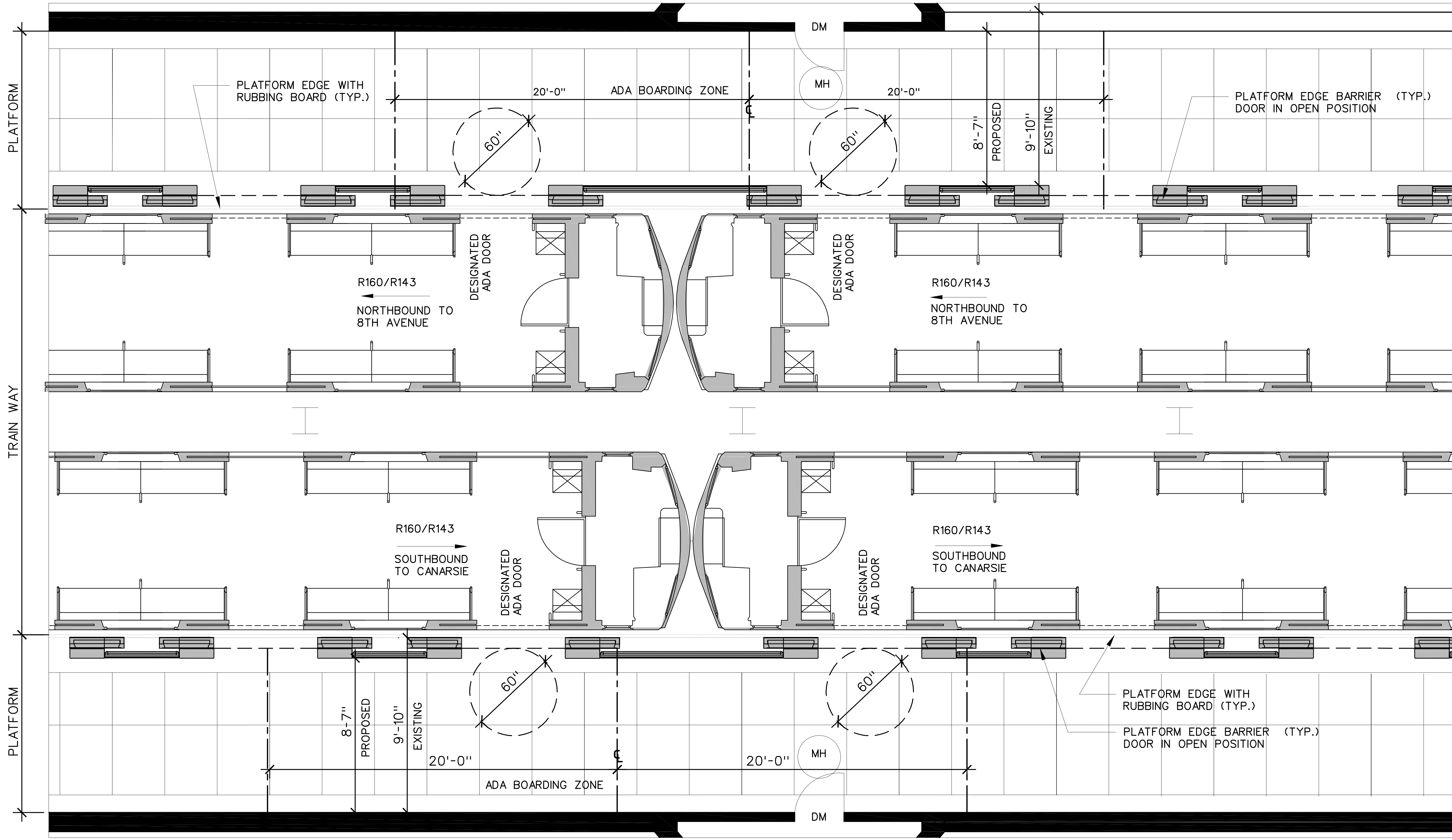
CANARSIE LINE - PLATFORM BARRIERS - ADA CLEARANCES & RESTRICTIONS ALONG PLATFORM EDGE

SEPTEMBER 15, 2017

0 50' 100'

MTA New York City Transit

STV 100 Years



PSK 4.2 - 1ST AVENUE STATION ENLARGED PLAN AT ADA BOARDING AREA

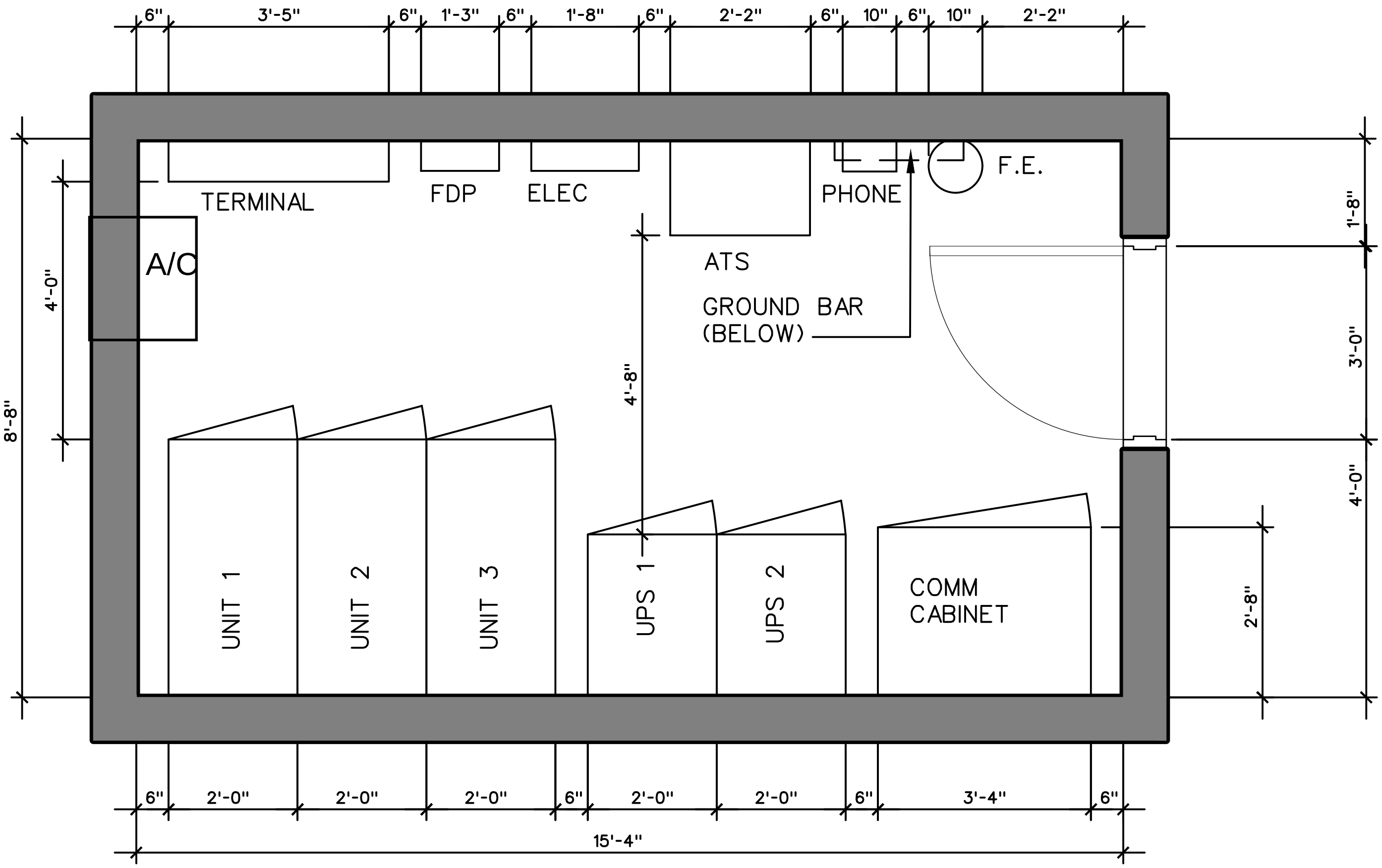
DETAIL FOR PLATFORM BARRIER CLEARANCES ALONG PLATFORM EDGE

0 24" 48" 96"

SEPTEMBER 15, 2017

New York City Transit

STV 100 Years



PSK - 6.1 - TYPICAL PLATFORM BARRIER EQUIPMENT ROOM ENLARGED PLAN

0 12" 24" 48"

SEPTEMBER 15, 2017

MTA New York City Transit

STV 100 Years

7.2 Cost Estimate

VJ ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue
ESTIMATE DATE:	July 28, 2017

VJ ASSOCIATES
ORDER OF MAGNITUDE COSTS

Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue

MTA/NYCT

July 28, 2017

BASIS OF ESTIMATE

1.00 Asbestos-Containing Materials (ACM) costs are excluded from this estimate.

2.00 Work is to be carried out during normal working hours - all train operations will be stopped

3.00 Escalation is calculated at 5% per annum based on APG Procurement Design Installation Timeline

4.00 Estimate includes costs associated with ADA zone concrete.

5.00 Estimate does not include State of Good Repair

6.00 NYCT project cost is not included

7.00 GO and flagging cost is not included

8.00 Maintenance / Operational Costs are not included. These will form part of a separate exercise

9.00 *Description of typical APG / PSD installation:*

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue

MTA/NYCT

July 28, 2017

BASIS OF ESTIMATE

9.0.1 *APGs / PSDs will provide 30 emergency egress doors with push bars per platform*

9.0.2 *APGs will be 4'-6" foot high system cantilevered from the platform*

9.0.3 *Each platform edge will have 8 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*

9.0.4 *Control Rooms will be 8 FT wide by 16 FT long and 8 FT tall; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls*

9.0.5 *Each Control Room will serve two platform edges*

9.0.6 *Control Rooms will be cooled to maintain operability of the control equipment*

9.0.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*

9.0.8 *Stray current isolation will be required* by *means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

9.0.9 *The existing platform edge lighting is to remain*

9.0.10 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue

MTA/NYCT

July 28, 2017

BASIS OF ESTIMATE

9.1 ***Assumptions:***

9.1.1 *Two-foot wide platform edge finish and topping slab will be removed down to the structural slab and new granite tile/tactile warning tile will be installed on the platform side of the APGs (assumed width of finish on platform side of APGs is 1'-0")*

9.1.2 *All platforms will require structural rehabilitation to take APG loads*

9.1.3 *There are no special security requirements made necessary by installation of the APG system*

9.2 ***Exclusions - Costs not included in the estimate:***

9.2.1 *Costs associated with construction of remote Control Rooms (at locations other than inside the station)*

9.2.2 *Costs associated with changes to train signals or systems*

9.2.3 *Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length*

9.2.4 *Costs associated with NYCT State Of Good Repair improvements to the station*

9.2.5 *Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.*

BASIS OF ESTIMATE

9.2.6 *For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs*

9.3 ***Below the line or "soft" costs:***

9.3.1 *Design and Construction Contingency*
9.3.2 *Contractor O & P*
9.3.3 *Insurance*
9.3.4 *NYCT project costs not included*

9.5 ***Additional Notes***

9.5.1 *Given the limited time available, no drawings were developed to support this estimate.*

'MTA /NYCT

Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue

LOCATION: CANARSIE LINE

July 28, 2017

ORDER OF MAGNITUDE COSTS

	DESCRIPTION		3RD AVENUE	14TH ST / UNION SQ	6TH AVENUE
1	AUTOMATIC PLATFORM GATES (APG'S)		$9,240,318	$9,102,166	$10,278,198
2	ADA ZONE		$43,764	ADA COMPLIANT	$43,764
3	ENVIRONMENTAL		$0	$210,800	$268,000
	TOTAL DIRECT COST		$9,284,082	$9,312,966	$10,589,962
4	GENERAL REQUIREMENTS	15.00%	$1,392,612	$1,396,945	$1,588,494
	SUB-TOTAL:		$10,676,695	$10,709,911	$12,178,457
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$2,669,174	$2,677,478	$3,044,614
	SUB-TOTAL:		$13,345,868	$13,387,389	$15,223,071
6	OVERHEAD & PROFIT	15.00%	$2,001,880	$2,008,108	$2,283,461
	SUB-TOTAL:		$15,347,749	$15,395,498	$17,506,532
7	BONDS & INSURANCE	3.75%	$575,541	$577,331	$656,495
	SUB-TOTAL:		$15,923,289	$15,972,829	$18,163,026
	SUB-TOTAL:		$15,923,289	$15,972,829	$18,163,026
	SUBTOTAL CONSTRUCTION COST W/O ACM		$15,923,289	$15,972,829	$18,163,026
8	ESCALATION TO CONSTRUCTION MID-POINT	11.93%	$1,899,680	$1,905,590	$2,166,885
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		$17,822,970	$17,878,419	$20,329,912
10	DESIGN CONSULTANT FEES	10.00%	$1,782,297	$1,787,842	$2,032,991
11	STATUTORY ADA IMPROVEMENTS*	20.00%	$3,810,361	ADA COMPLIANT	$4,361,888
	TOTAL PROJECT COST		$23,415,627	$19,666,261	$26,724,791

* Statutory ADA Improvements adjusted to remove Item 02 above [ADA Zone]

'MTA /NYCT

Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue

LOCATION: CANARSIE LINE

July 28, 2017

ORDER OF MAGNITUDE COSTS

	DESCRIPTION		3RD AVENUE	14TH ST / UNION SQ	6TH AVENUE
ADD ALTERNATIVES					
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		1,525,900	1,442,410	1,961,500
	Add for Markups (as above)	152.21%	2,322,612	2,195,530	2,985,651
			$3,848,512	$3,637,940	$4,947,151
B1	Additional cost associated with CBTC Berthing System in lieu of Wayside only system		2,229,912	2,229,912	2,229,912
	Add for Markups (as above)	152.21%	3,394,208	3,394,208	3,394,208
			$5,624,120	$5,624,120	$5,624,120
B2	Additional cost associated with Dedicated loop Berthing System in lieu of Wayside only system		2,603,028	2,603,028	2,603,028
	Add for Markups (as above)	152.21%	3,962,137	3,962,137	3,962,137
			$6,565,165	$6,565,165	$6,565,165

MTA/NYCT

Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue

28-Jul-17

STATION: 3RD AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 106 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4					
5	TOTAL LENGTH OF THE PLATFORM EDGE = 530' x 2 No. EDGES	1,060	LF		
6					
7	AUTOMATIC PLATFORM GATES [APG's]				
8					
9	NEW WORK				
10					
11	REBUILD CONCRETE EDGE				
12	Remove existing tatile warning strip 2' wide	1,060	LF	$15.00	15,900
13	Remove existing polyethylene edge strip	1,060	LF	$7.00	7,420
14	Remove and construct Reinforced concrete edge 9" wide	1,060	LF	$250.00	265,000
15	Tactile warning strip 2' wide	2,120	SF	$110.00	233,200
16	Polyethylene edge strip	1,060	LF	$95.00	100,700
17	Misc. patchwork	1	LS	$50,000.00	50,000
18					
19	Automatic Platform Gates [APGs] - 4'-6" High				
20	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	$15,000.00	960,000

MTA/NYCT

Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue

28-Jul-17

STATION: 3RD AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
21	Glass fence including framing and support; 4'-6" High	3,042	SF	$750.00	2,281,500
22	"Extra over" above for push bar operated emergency egress gates; single swing hinged (Allow 30 no. per platform)	60	EA	$3,500.00	210,000
23	Allow for conduit / cable runs for power and communications under platform edge	1,060	LF	$60.00	63,600
24	Allowance for Braille Signage	64	EA	$2,500.00	160,000
25	Testing and commissioning	500	HRS	$152.43	76,215
26					
27	CCTV coverage				
28	Cameras [8 No. per platform]	16	EA	$2,000.00	32,000
29	Application Access Node	3	EA	$20,000.00	60,000
30	Conduit to wireway	240	LF	$20.00	4,800
31	Wire from cameras to the new Application Access Node in the area	800	LF	$10.00	8,000
32	Connection Application Acces Node to existing Access Node	2	EA	$2,000.00	4,000
33					
34	Communication / Control Room [8'-0" x 16'-0"]				
35	CMU Wall for control room	384	SF	$45.00	17,280
36	Door including frame & hardware	1	EA	$1,800.00	1,800
37	Glazed Ceramic Wall on Exterior (4 side of Wall)	384	SF	$35.00	13,440
38	Interior Wall Finishes	384	SF	$5.00	1,920
39	Construct Ceiling at Control Room	128	SF	$20.00	2,560
40	Provision of Cooling System	1	LS	$7,500.00	7,500
41	Allow for Electrical Work inside Control Room	1	LS	$10,000.00	10,000
42	Allow for Misc. Floor & ceiling finishes	128	SF	$15.00	1,920
43	Allowance to bring power to Control Room from EDR [Full length of platform]	530	LF	$60.00	31,800
44	Allowance for power to cross tracks to opposite platform	1	LS	$15,000.00	15,000
45	Allowance to bring fiber optic to Control Room from network node	1	LS	$15,000.00	15,000
46					
47	Berthing Technology				

Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue

28-Jul-17

STATION: 3RD AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
48	Allowance for Berthing Technology for Control Train Berthing				
49	Allowance for "Wayside Only" berthing system as per "Berthing Control System Comparison" Report	1	LS	$732,000.00	732,000
50					
51	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.				
52	System-wide Cost [expressed as a cost per station i.e. 1/620 or 0.16%]	0.16%	LS	$1,500,000.00	2,419
53					
54	Entrapment concerns				
55	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	$4,629.24	888,814
56	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	$4,877.76	936,530
57					
58	Grounding				
59	Allowance for new grounding wiring for structural steel throughout station	1	LS	$30,000.00	30,000
60					
61	Platform edge lighting				
62	No allowance for new lighting		Note		EXCL.
63					
64	Electrical Upgrades				
65	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
66					
67	Structural Rehabilitation				

MTA/NYCT

Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue

28-Jul-17

STATION: 3RD AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
68	Allowance for Structural Rehabilitation - $1,000,000 per platform edge x 2 No. edges	1	LS	$2,000,000.00	2,000,000
69					
70	Out of hours Work				
71	No allowance included for work outside normal working hours		Note		EXCL.
72					
73					
74	TOTAL PSD WORK:				$ 9,240,318
75					
76	PLATFORM ADA ZONE				
77					
78	DEMOLITION				
79	Remove platform concrete topping slab	1,040	SF	8.00	8,320
80	Scarify existing exposed platform slab to receive new concrete topping	1,040	SF	6.00	6,240
81	Remove existing conductor boards	4	EA	225.00	900
82					
83	NEW WORK				
84	New 3" concrete topping to ADA platform area	1,040	SF	22.00	22,880
85	Photo-luminecent strip	104	LF	6.00	624
86	New conductor board [8' x 2'-5"]	4	EA	1,200.00	4,800
87					
88					
89	TOTAL ADA ZONE:				$ 43,764

MTA/NYCT

Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue

28-Jul-17

STATION: 14TH STREET / UNION SQUARE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 106 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4					
5	TOTAL LENGTH OF THE PLATFORM EDGE = 507' x 2 No. EDGES	1,014	LF		
6					
7	AUTOMATIC PLATFORM GATES [APG's]				
8					
9	NEW WORK				
10					
11	REBUILD CONCRETE EDGE				
12	Remove existing tatile warning strip 2' wide	1,014	LF	$15.00	15,210
13	Remove existing polyethylene edge strip	1,014	LF	$7.00	7,098
14	Remove and construct Reinforced concrete edge 9" wide	1,014	LF	$250.00	253,500
15	Tactile warning strip 2' wide	2,028	SF	$110.00	223,080
16	Polyethylene edge strip	1,014	LF	$95.00	96,330
17	Misc. patchwork	1	LS	$50,000.00	50,000
18					
19	Automatic Platform Gates [APGs] - 4'-6" High				
20	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	$15,000.00	960,000
21	Glass fence including framing and support; 4'-6" High	2,835	SF	$750.00	2,126,250
22	"Extra over" above for push bar operated emergency egress gates; single swing hinged (30 no. per platform)	60	EA	$3,500.00	210,000

MTA/NYCT

Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue

28-Jul-17

STATION: 14TH STREET / UNION SQUARE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
23	Allow for conduit / cable runs for power and communications under platform edge	1,014	LF	$60.00	60,840
24	Allowance for Braille Signage	64	EA	$2,500.00	160,000
25	Testing and commissioning	500	HRS	$152.43	76,215
26					
27	CCTV coverage				
28	Cameras [8 No. per platform]	16	EA	$2,000.00	32,000
29	Application Access Node	3	EA	$20,000.00	60,000
30	Conduit to wireway	240	LF	$20.00	4,800
31	Wire from cameras to the new Application Access Node in the area	800	LF	$10.00	8,000
32	Connection Application Acces Node to existing Access Node	2	EA	$2,000.00	4,000
33					
34	Communication / Control Room [8'-0" x 16'-0"]				
35	CMU Wall for control room	384	SF	$45.00	17,280
36	Door including frame & hardware	1	EA	$1,800.00	1,800
37	Glazed Ceramic Wall on Exterior (4 side of Wall)	384	SF	$35.00	13,440
38	Interior Wall Finishes	384	SF	$5.00	1,920
39	Construct Ceiling at Control Room	128	SF	$20.00	2,560
40	Provision of Cooling System	1	LS	$7,500.00	7,500
41	Allow for Electrical Work inside Control Room	1	LS	$10,000.00	10,000
42	Allow for Misc. Floor & ceiling finishes	128	SF	$15.00	1,920
43	Allowance to bring power to Control Room from EDR [Full length of platform]	507	LF	$60.00	30,420
44	Crossing not applicable - Island Platform		Note		EXCL.
45	Allowance to bring fiber optic to Control Room from network node	1	LS	$15,000.00	15,000
46					
47	Berthing Technology				
48	Allowance for Berthing Technology for Control Train Berthing				
49	Allowance for "Wayside Only" berthing system as per "Berthing Control System Comparison" Report	1	LS	$732,000.00	732,000
50					

MTA/NYCT

Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue

28-Jul-17

STATION: 14TH STREET / UNION SQUARE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
51	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.				
52	- System-wide Cost [expressed as a cost per station i.e. 1/620 or 0.16%]	0.16%	LS	$1,500,000.00	2,419
53					
54	Entrapment concerns				
55	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	$4,629.24	888,814
56	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	$4,877.76	936,530
58	Grounding				
59	Paint column with "Non Conductive Paint"; Extent of columns on each platform to be established	53	EA	$1,200.00	63,240
60	Allowance for new grounding wiring for structural steel throughout station	1	LS	$30,000.00	30,000
61					
62	Platform edge lighting				
63	No allowance for new lighting		Note		EXCL.
64					
65	Electrical Upgrades				
66	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
67					
68	Structural Rehabilitation				
69	Allowance for Structural Rehabilitation - $1,000,000 per platform edge x 2 No. edges	1	LS	$2,000,000.00	2,000,000
70					
71	Out of hours Work				

MTA/NYCT

Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue

28-Jul-17

STATION: 14TH STREET / UNION SQUARE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
72	No allowance included for work outside normal working hours		Note		EXCL.
73					
74					
75	TOTAL PSD WORK:				$ 9,102,166
76					
77	PLATFORM ADA ZONE				
78					
79	DEMOLITION				
80	Remove platform concrete topping slab	1,040	SF	8.00	8,320
81	Scarify existing exposed platform slab to receive new concrete topping	1,040	SF	6.00	6,240
82	Remove existing conductor boards	4	EA	225.00	900
83					
84	NEW WORK				
85	New 3" concrete topping to ADA platform area	1,040	SF	22.00	22,880
86	Photo-luminecent strip	104	LF	6.00	624
87	New conductor board [8' x 2'-5"]	4	EA	1,200.00	4,800
88					
89					
90	TOTAL ADA ZONE:				$ 43,764
91					
92	ENVIRONMENTAL				
93					
94	Allowance for stripping existing paint (assuming lead contaminated) from existing columns and leave ready to receive new finish; Extent of columns on each platform to be established	53	COLS	4,000.00	$ 210,800
95					
96					
97	TOTAL ENVIRONMENTAL:				$ 210,800

MTA/NYCT

Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue

28-Jul-17

STATION: 6TH AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 106 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4					
5	TOTAL LENGTH OF THE PLATFORM EDGE = 650' x 2 No. EDGES	1,300	LF		
6					
7	AUTOMATIC PLATFORM GATES [APG's]				
8					
9	NEW WORK				
10					
11	REBUILD CONCRETE EDGE				
12	Remove existing tatile warning strip 2' wide	1,300	LF	$15.00	19,500
13	Remove existing polyethylene edge strip	1,300	LF	$7.00	9,100
14	Remove and construct Reinforced concrete edge 9" wide	1,300	LF	$250.00	325,000
15	Tactile warning strip 2' wide	2,600	SF	$110.00	286,000
16	Polyethylene edge strip	1,300	LF	$95.00	123,500
17	Misc. patchwork	1	LS	$50,000.00	50,000
18					
19	Automatic Platform Gates [APGs] - 4'-6" High				
20	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	$15,000.00	960,000
21	Glass fence including framing and support; 4'-6" High	4,122	SF	$750.00	3,091,500
22	"Extra over" above for push bar operated emergency egress gates; single swing hinged (30 no. per platform)	60	EA	$3,500.00	210,000

MTA/NYCT

Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue

28-Jul-17

STATION: 6TH AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
23	Allow for conduit / cable runs for power and communications under platform edge	1,300	LF	$60.00	78,000
24	Allowance for Braille Signage	64	EA	$2,500.00	160,000
25	Testing and commissioning	500	HRS	$152.43	76,215
26					
27	CCTV coverage				
28	Cameras [8 No. per platform]	16	EA	$2,000.00	32,000
29	Application Access Node	3	EA	$20,000.00	60,000
30	Conduit to wireway	240	LF	$20.00	4,800
31	Wire from cameras to the new Application Access Node in the area	800	LF	$10.00	8,000
32	Connection Application Acces Node to existing Access Node	2	EA	$2,000.00	4,000
33					
34	Communication / Control Room [8'-0" x 16'-0"]				
35	CMU Wall for control room	384	SF	$45.00	17,280
36	Door including frame & hardware	1	EA	$1,800.00	1,800
37	Glazed Ceramic Wall on Exterior (4 side of Wall)	384	SF	$35.00	13,440
38	Interior Wall Finishes	384	SF	$5.00	1,920
39	Construct Ceiling at Control Room	128	SF	$20.00	2,560
40	Provision of Cooling System	1	LS	$7,500.00	7,500
41	Allow for Electrical Work inside Control Room	1	LS	$10,000.00	10,000
42	Allow for Misc. Floor & ceiling finishes	128	SF	$15.00	1,920
43	Allowance to bring power to Control Room from EDR [Full length of platform]	650	LF	$60.00	39,000
44	Crossing not applicable - Island Platform		Note		EXCL.
45	Allowance to bring fiber optic to Control Room from network node	1	LS	$15,000.00	15,000
46					
47	Berthing Technology				
48	Allowance for Berthing Technology for Control Train Berthing				
49	Allowance for "Wayside Only" berthing system as per "Berthing Control System Comparison" Report	1	LS	$732,000.00	732,000
50					

MTA/NYCT

Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue

28-Jul-17

STATION: 6TH AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
51	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.				
52	- System-wide Cost [expressed as a cost per station i.e. 1/620 or 0.16%]	0.16%	LS	$1,500,000.00	2,419
53					
54	Entrapment concerns				
55	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	$4,629.24	888,814
56	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	$4,877.76	936,530
57					
58	Grounding				
59	Paint column with "Non Conductive Paint"; Extent of columns on each platform to be established	67	EA	$1,200.00	80,400
60	Allowance for new grounding wiring for structural steel throughout station	1	LS	$30,000.00	30,000
61					
62	Platform edge lighting				
63	No allowance for new lighting		Note		EXCL.
64					
65	Electrical Upgrades				
66	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
67					
68	Structural Rehabilitation				
69	Allowance for Structural Rehabilitation - $1,000,000 per platform edge x 2 No. edges	1	LS	$2,000,000.00	2,000,000
70					
71	Out of hours Work				

MTA/NYCT

Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue

28-Jul-17

STATION: 6TH AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
72	No allowance included for work outside normal working hours		Note		EXCL.
73					
74					
75	TOTAL PSD WORK:				$ 10,278,198
76					
77	PLATFORM ADA ZONE				
78					
79	DEMOLITION				
80	Remove platform concrete topping slab	1,040	SF	8.00	8,320
81	Scarify existing exposed platform slab to receive new concrete topping	1,040	SF	6.00	6,240
82	Remove existing conductor boards	4	EA	225.00	900
83					
84	NEW WORK				
85	New 3" concrete topping to ADA platform area	1,040	SF	22.00	22,880
86	Photo-luminecent strip	104	LF	6.00	624
87	New conductor board [8' x 2'-5"]	4	EA	1,200.00	4,800
88					
89					
90	TOTAL ADA ZONE:				$ 43,764
91					
92	ENVIRONMENTAL				
93					
94	Allowance for stripping existing paint (assuming lead contaminated) from existing columns and leave ready to receive new finish; Extent of columns on each platform to be established	67	COLS	4,000.00	$ 268,000
95					
96					
97	TOTAL ENVIRONMENTAL:				$ 268,000

ESCALATION ANALYSIS

		SCHEDULE						ESCALATION @ 5% PER YEAR		
		Construction Duration								
Contract No.	Description	Base Year	Start Date	End Date	Calender Days	Contract Duration Months	Mid-Point Date of Construction	Duration to Mid-Point of Construction from Base (Cal Days)	Mid-Point Duration from Base (Years)	Escalation Rate 5% (@ Mid-Point)
	Study for the installation of PSD's at selected station on the Canarsie Line - 3rd Avenue, 14th Street / Union Square or 6th Avenue	Jul 28, 2017	Apr 1, 2019	Jun 30, 2020	456	15	Nov 15, 2019	840	2.31	11.93%

VJ ASSOCIATES
A CONSTRUCTION CONSULTING FIRM

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32514
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	STUDY FOR THE INSTALLATION OF PSD'S AT SELECTED STATION ON THE CANARSIE LINE - 1ST AVENUE STATION
ESTIMATE DATE:	September 14, 2017

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

STUDY FOR THE INSTALLATION OF PSD'S AT SELECTED STATION ON THE CANARSIE LINE - 1ST AVENUE STATION

MTA/NYCT

September 14, 2017

BASIS OF ESTIMATE

1.00 Asbestos-Containing Materials (ACM) costs are excluded from this estimate.

2.00 Work is to be carried out during normal working hours - all train operations will be stopped

3.00 Escalation is calculated at 5% per annum based on APG Procurement Design Installation Timeline

4.00 Estimate includes costs associated with ADA zone concrete.

5.00 Estimate does not include State of Good Repair

6.00 NYCT project cost is not included

7.00 GO and flagging cost is not included

8.00 Maintenance / Operational Costs are not included. These will form part of a separate exercise

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

STUDY FOR THE INSTALLATION OF PSD'S AT SELECTED STATION ON THE CANARSIE LINE - 1ST AVENUE STATION

MTA/NYCT

September 14, 2017

BASIS OF ESTIMATE

9.00 ***Description of typical APG / PSD installation:***

9.0.1 *APGs / PSDs will provide 30 emergency egress doors with push bars per platform*
9.0.2 *APGs will be 4'-6" foot high system cantilevered from the platform*
9.0.3 *Each platform edge will have 8 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
9.0.4 *Control Rooms will be 8 FT wide by 16 FT long and 8 FT tall; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls*
9.0.5 *Each Control Room will serve two platform edges*
9.0.6 *Control Rooms will be cooled to maintain operability of the control equipment*
9.0.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
9.0.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

9.0.9 *The existing platform edge lighting is to remain*
9.0.10 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

STUDY FOR THE INSTALLATION OF PSD'S AT SELECTED STATION ON THE CANARSIE LINE - 1ST AVENUE STATION

MTA/NYCT

September 14, 2017

BASIS OF ESTIMATE

9.1 ***Assumptions:***

9.1.1 *Two-foot wide platform edge finish and topping slab will be removed down to the structural slab and new granite tile/tactile warning tile will be installed on the platform side of the APGs (assumed width of finish on platform side of APGs is 1'-0")*

9.1.2 *All platforms will require structural rehabilitation to take APG loads*

9.1.3 *There are no special security requirements made necessary by installation of the APG system*

9.2 ***Exclusions - Costs not included in the estimate:***

9.2.1 *Costs associated with construction of remote Control Rooms (at locations other than inside the station)*

9.2.2 *Costs associated with changes to train signals or systems*

9.2.3 *Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length*

9.2.4 *Costs associated with NYCT State Of Good Repair improvements to the station*

9.2.5 *Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.*

BASIS OF ESTIMATE

9.2.6 *For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs*

9.3 ***Below the line or "soft" costs:***

9.3.1 *Design and Construction Contingency*
9.3.2 *Contractor O & P*
9.3.3 *Insurance*
9.3.4 *NYCT project costs not included*

9.5 ***Additional Notes***

9.5.1 *Given the limited time available, no drawings were developed to support this estimate.*

'MTA /NYCT

STUDY FOR THE INSTALLATION OF PSD'S AT SELECTED STATION ON THE CANARSIE LINE - 1ST AVENUE STATION

LOCATION: CANARSIE LINE 14-Sep-17

ORDER OF MAGNITUDE COSTS

DESCRIPTION				1ST AVENUE
1	AUTOMATIC PLATFORM GATES (APG'S)			$9,032,458
2	ADA ZONE			$43,764
3	ENVIRONMENTAL			$0
		TOTAL DIRECT COST		$9,076,222
4	GENERAL REQUIREMENTS		15.00%	$1,361,433
		SUB-TOTAL:		$10,437,656
5	ALLOWANCE FOR INDETERMINATES (AFI)		25.00%	$2,609,414
		SUB-TOTAL:		$13,047,070
6	OVERHEAD & PROFIT		15.00%	$1,957,060
		SUB-TOTAL:		$15,004,130
7	BONDS & INSURANCE		3.75%	$562,655
		SUB-TOTAL:		$15,566,785
		SUB-TOTAL:		$15,566,785
	SUBTOTAL CONSTRUCTION COST W/O ACM			$15,566,785
8	ESCALATION TO CONSTRUCTION MID-POINT		11.17%	$1,738,538
9	ACM ABATEMENT			BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM			$17,305,323
10	DESIGN CONSULTANT FEES		10.00%	$1,730,532
11	STATURORY ADA IMPROVEMENTS*		20.00%	$3,696,479
	TOTAL PROJECT COST			$22,732,334

'MTA /NYCT

STUDY FOR THE INSTALLATION OF PSD'S AT SELECTED STATION ON THE CANARSIE LINE - 1ST AVENUE STATION

LOCATION: CANARSIE LINE 14-Sep-17

ORDER OF MAGNITUDE COSTS

DESCRIPTION			1ST AVENUE
ADD ALTERNATIVES			
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		1,426,075
	Add for Markups (as above)	150.46%	2,145,677
			$3,571,752
B1	Additional cost associated with CBTC Berthing System in lieu of Wayside only system		2,229,912
	Add for Markups (as above)	150.46%	3,355,132
			$5,585,044
B2	Additional cost associated with Dedicated loop Berthing System in lieu of Wayside only system		2,603,028
	Add for Markups (as above)	150.46%	3,916,524
			$6,519,552

MTA/NYCT

STUDY FOR THE INSTALLATION OF PSD'S AT SELECTED STATION ON THE CANARSIE LINE - 1ST AVENUE STATION

14-Sep-17

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 106 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4					
5	TOTAL LENGTH OF THE PLATFORM EDGE = 500' [EDGE 01] + 505' [EDGE 02] =	1,005	LF		
6					
7	AUTOMATIC PLATFORM GATES [APG's]				
8					
9	DEMOLITION				
10	Demolition of existing EDR Room	1	LS	15,000.00	15,000
11	Relocation of electrical equipment prior to demolition of EDR room - BY OTHERS		Note		NIC
12					
13	NEW WORK				
14					
15	REBUILD CONCRETE EDGE				
16	Remove existing tatile warning strip 2' wide	1,005	LF	$15.00	15,075
17	Remove existing polyethylene edge strip	1,005	LF	$7.00	7,035
18	Remove and construct Reinforced concrete edge 9" wide	1,005	LF	$250.00	251,250
19	Tactile warning strip 2' wide	2,010	SF	$110.00	221,100

MTA/NYCT

STUDY FOR THE INSTALLATION OF PSD'S AT SELECTED STATION ON THE CANARSIE LINE -
1ST AVENUE STATION

14-Sep-17

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
20	Polyethylene edge strip	1,005	LF	$95.00	95,475
21	Misc. patchwork	1	LS	$50,000.00	50,000
22					
23	**Automatic Platform Gates [APGs] - 4'-6" High**				
24	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	$15,000.00	960,000
25	Glass fence including framing and support; 4'-6" High	2,795	SF	$750.00	2,095,875
26	"Extra over" above for push bar operated emergency egress gates; single swing hinged (Allow 30 no. per platform)	60	EA	$3,500.00	210,000
27	Allow for conduit / cable runs for power and communications under platform edge	1,005	LF	$60.00	60,300
28	Allowance for Braille Signage	64	EA	$2,500.00	160,000
29	Testing and commissioning	500	HRS	$152.43	76,215
30					
31	**CCTV coverage**				
32	Cameras [8 No. per platform]	16	EA	$2,000.00	32,000
33	Application Access Node	3	EA	$20,000.00	60,000
34	Conduit to wireway	240	LF	$20.00	4,800
35	Wire from cameras to the new Application Access Node in the area	800	LF	$10.00	8,000
36	Connection Application Acces Node to existing Access Node	2	EA	$2,000.00	4,000
37					
38	**Communication / Control Room [8'-0" x 16'-0"]**				
39	CMU Wall for control room	384	SF	$45.00	17,280
40	Door including frame & hardware	1	EA	$1,800.00	1,800
41	Glazed Ceramic Wall on Exterior (4 side of Wall)	384	SF	$35.00	13,440
42	Interior Wall Finishes	384	SF	$5.00	1,920
43	Construct Ceiling at Control Room	128	SF	$20.00	2,560
44	Provision of Cooling System	1	LS	$7,500.00	7,500
45	Allow for Electrical Work inside Control Room	1	LS	$10,000.00	10,000
46	Allow for Misc. Floor & ceiling finishes	128	SF	$15.00	1,920

MTA/NYCT

STUDY FOR THE INSTALLATION OF PSD'S AT SELECTED STATION ON THE CANARSIE LINE - 1ST AVENUE STATION

14-Sep-17

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
47	Allowance to bring power to Control Room from EDR [Full length of platform]	503	LF	$60.00	30,150
48	Allowance for power to cross tracks to opposite platform	1	LS	$15,000.00	15,000
49	Allowance to bring fiber optic to Control Room from network node	1	LS	$15,000.00	15,000
50					
51	Berthing Technology				
52	Allowance for Berthing Technology for Control Train Berthing				
53	Allowance for "Wayside Only" berthing system as per "Berthing Control System Comparison" Report	1	LS	$732,000.00	732,000
54					
55	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.				
56	System-wide Cost [expressed as a cost per station i.e. 1/620 or 0.16%]	0.16%	LS	$1,500,000.00	2,419
57					
58	Entrapment concerns				
59	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	$4,629.24	888,814
60	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	$4,877.76	936,530
61					
62	Grounding				
63	Allowance for new grounding wiring for structural steel throughout station	1	LS	$30,000.00	30,000
64					
65	Platform edge lighting				
66	No allowance for new lighting		Note		EXCL.

MTA/NYCT

STUDY FOR THE INSTALLATION OF PSD'S AT SELECTED STATION ON THE CANARSIE LINE - 1ST AVENUE STATION

14-Sep-17

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
67					
68	Electrical Upgrades				
69	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
70					
71	Structural Rehabilitation				
72	Allowance for Structural Rehabilitation - $1,000,000 per platform edge x 2 No. edges	1	LS	$2,000,000.00	2,000,000
73					
74	Out of hours Work				
75	No allowance included for work outside normal working hours		Note		EXCL.
76					
77					
78	TOTAL PSD WORK:				$ 9,032,458
79					
80	PLATFORM ADA ZONE				
81					
82	DEMOLITION				
83	Remove platform concrete topping slab	1,040	SF	8.00	8,320
84	Scarify existing exposed platform slab to receive new concrete topping	1,040	SF	6.00	6,240
85	Remove existing conductor boards	4	EA	225.00	900
86					
87	NEW WORK				
88	New 3" concrete topping to ADA platform area	1,040	SF	22.00	22,880
89	Photo-luminecent strip	104	LF	6.00	624
90	New conductor board [8' x 2'-5"]	4	EA	1,200.00	4,800
91					
92					
93	TOTAL ADA ZONE:				$ 43,764

ESCALATION ANALYSIS

		SCHEDULE						ESCALATION @ 5% PER YEAR		
		Construction Duration								
Contract No.	Description	Base Year	Start Date	End Date	Calender Days	Contract Duration Months	Mid-Point Date of Construction	Duration to Mid-Point of Construction from Base (Cal Days)	Mid-Point Duration from Base (Years)	Escalation Rate 5% (@ Mid-Point)
	STUDY FOR THE INSTALLATION OF PSD'S AT SELECTED STATION ON THE CANARSIE LINE - 1ST AVENUE STATION	Sep 14, 2017	Apr 1, 2019	Jun 30, 2020	456	15	Nov 15, 2019	792	2.17	11.17%

Appendix E – Rough Order of Magnitude Costs

VJ ASSOCIATES
A CONSTRUCTION CONSULTING FIRM

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32514
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn
ESTIMATE DATE:	June 22, 2018

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1080

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

MTA/NYCT

June 22, 2018

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs / PSDs will provide 32 emergency egress doors with push bars per platform*
1.2 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.3 *Each platform edge will have 40 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.2 In respect of the PSD option, only platforms that have not been upgraded in the recent past (assuming over the past two decades) will require platform edge replacement.
2.3 There are no special security requirements made necessary by installation of the APG system
2.4 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.5 This estimate does not provide for the replacement of Platform Edge Lighting
2.6 Premium cost for night time work is considered 50% of total labor cost

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

MTA/NYCT

June 22, 2018

BASIS OF ESTIMATE

3.0 *Exclusions - Costs not included in the estimate:*

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems

3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length

3.4 Costs associated with NYCT State Of Good Repair improvements to the station

3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.

3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs

3.7 Escalation Cost is not included; Anticipate at 5% per annum.

3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.

3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium

3.10 NYCT project cost is not included

3.11 GO and flagging cost is not included

3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 *Below the line or "soft" costs:*

4.1 Design and Construction Contingency

4.2 Contractor O & P

4.3 Insurance

4.4 NYCT project costs not included

5.0 *Additional Notes*

5.1 *Given the limited time available, no drawings were developed to support this estimate.*

MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

LOCATION: 'L' LINE STATIONS, BROOKLYN

June 22, 2018

	ORDER OF MAGNITUDE COSTS		MR-115	MR-119	MR-122	MR-123	MR-124	MR-125	MR-126	MR-127	MR-128	MR-129	MR-130	MR-131	MR-132
	DESCRIPTION		8TH AVENUE	1ST AVENUE	GRAHAM AVE	GRAND STREET	MONTROSE AVE	MORGAN AVE	JEFFERSON STREET	DEKALB AVE	MYRTLE-WYCKOFF AVENUES	HALSEY STREET	WILSON AVE	BUSHWICK AVE - ABERDEEN STREET	BROADWAY JUNCTION
1	AUTOMATIC PLATFORM GATES (APG'S)		$14,825,767	$14,421,679	$15,209,980	$15,189,414	$14,829,339	$14,806,579	$14,864,945	$14,818,331	$14,791,057	$14,796,569	$15,188,766	$15,179,783	$14,788,769
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$14,825,767	$14,421,679	$15,209,980	$15,189,414	$14,829,339	$14,806,579	$14,864,945	$14,818,331	$14,791,057	$14,796,569	$15,188,766	$15,179,783	$14,788,769
4	GENERAL REQUIREMENTS	15.00%	$2,223,865	$2,163,252	$2,281,497	$2,278,412	$2,224,401	$2,220,987	$2,229,742	$2,222,750	$2,218,659	$2,219,485	$2,278,315	$2,276,967	$2,218,315
	SUB-TOTAL:		$17,049,632	$16,584,930	$17,491,477	$17,467,826	$17,053,739	$17,027,566	$17,094,687	$17,041,081	$17,009,716	$17,016,055	$17,467,081	$17,456,751	$17,007,085
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,262,408	$4,146,233	$4,372,869	$4,366,956	$4,263,435	$4,256,892	$4,273,672	$4,260,270	$4,252,429	$4,254,014	$4,366,770	$4,364,188	$4,251,771
	SUB-TOTAL:		$21,312,040	$20,731,163	$21,864,346	$21,834,782	$21,317,174	$21,284,458	$21,368,358	$21,301,351	$21,262,145	$21,270,068	$21,833,852	$21,820,938	$21,258,856
6	OVERHEAD & PROFIT	15.00%	$3,196,806	$3,109,674	$3,279,652	$3,275,217	$3,197,576	$3,192,669	$3,205,254	$3,195,203	$3,189,322	$3,190,510	$3,275,078	$3,273,141	$3,188,828
	SUB-TOTAL:		$24,508,847	$23,840,837	$25,143,998	$25,109,999	$24,514,750	$24,477,126	$24,573,612	$24,496,554	$24,451,467	$24,460,579	$25,108,929	$25,094,079	$24,447,684
7	BONDS & INSURANCE	3.75%	$919,082	$894,031	$942,900	$941,625	$919,303	$917,892	$921,510	$918,621	$916,930	$917,272	$941,585	$941,028	$916,788
	SUB-TOTAL:		$25,427,928	$24,734,869	$26,086,898	$26,051,624	$25,434,054	$25,395,019	$25,495,122	$25,415,175	$25,368,397	$25,377,850	$26,050,514	$26,035,107	$25,364,472
	SUB-TOTAL:		$25,427,928	$24,734,869	$26,086,898	$26,051,624	$25,434,054	$25,395,019	$25,495,122	$25,415,175	$25,368,397	$25,377,850	$26,050,514	$26,035,107	$25,364,472
	SUBTOTAL CONSTRUCTION COST W/O ACM		$25,427,928	$24,734,869	$26,086,898	$26,051,624	$25,434,054	$25,395,019	$25,495,122	$25,415,175	$25,368,397	$25,377,850	$26,050,514	$26,035,107	$25,364,472
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		$25,427,928	$24,734,869	$26,086,898	$26,051,624	$25,434,054	$25,395,019	$25,495,122	$25,415,175	$25,368,397	$25,377,850	$26,050,514	$26,035,107	$25,364,472
10	DESIGN CONSULTANT FEES	10.00%	$2,542,793	$2,473,487	$2,608,690	$2,605,162	$2,543,405	$2,539,502	$2,549,512	$2,541,517	$2,536,840	$2,537,785	$2,605,051	$2,603,511	$2,536,447
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST		$27,970,721	$27,208,356	$28,695,587	$28,656,787	$27,977,459	$27,934,520	$28,044,635	$27,956,692	$27,905,236	$27,915,635	$28,655,566	$28,638,618	$27,900,920

	ADD ALTERNATIVES														
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		3,738,305	3,673,582	3,943,913	3,943,913	3,943,913	3,943,913	3,943,913	3,943,913	3,943,913	3,943,913	3,738,305	3,943,913	3,738,305
	Add for Markups (as above)	88.66%	3,314,489	3,257,104	3,496,787	3,496,787	3,496,787	3,496,787	3,496,787	3,496,787	3,496,787	3,496,787	3,314,489	3,496,787	3,314,489
			$7,052,794	$6,930,686	$7,440,700	$7,440,700	$7,440,700	$7,440,700	$7,440,700	$7,440,700	$7,440,700	$7,440,700	$7,052,794	$7,440,700	$7,052,794

22-Jun-18

STATION: 8TH AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	540	LF		
5	LENGTH OF THE PLATFORM EDGE [CANARSIE BOUND] =	540	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,080	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,080	LF	7	7,560
13	Remove 5' wide section of 3" deep structural slab to platform edge	5,400	SF	12	64,800
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	100	CY	2,500	250,000
16	Pair of dowels (front & rear) cast into existing at 12" O.C	2,164	EA	25	54,100
17	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
18	Polyethylene edge strip	1,080	LF	95	102,600
19	Provide sleeves for HV & LV wires	256	EA	110	28,160
20					
21	Platform edge finishes				
22	Demolition				
23	Remove existing tactile warning strip 2' wide	1,080	LF	15	16,200
24	Remove existing platform tiles	1,080	LF	12	12,960
25	Sawcut existing topping concrete at perimeter of removal area	1,080	LF	5	5,400
26	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,480	SF	8	51,840
27	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 20' wide strip at ADA boarding area	1,120	SF	8	8,960
28	New Work				
29	New concrete topping to match existing	1,080	SF	15	16,200
30	New concrete topping at ADA boarding area to match existing	1,120	SF	15	16,800
31	Tactile Warning Strip - 2' wide strip along platform edge at door openings only (#32) & Platform end gates	384	LF	110	42,240
32	Misc. patchwork	1	LS	50,000	50,000
33					
34	Equipment Room [8'-0" x 30'-0"]				
35	Build off existing platform slab		Note		
36	Form 8" wide concrete curb including dowelling to platform slab	46	LF	90	4,140
37	CMU Wall for equipment room	460	SF	45	20,700
38	Vertical connections with existing structure	20	LF	25	500
39	Fire rated door including frame & hardware	1	EA	2,500	2,500
40	Exterior wall finish				

STATION: 8TH AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
41	Ceramic Tiling to match existing	460	SF	40	18,400
42	Mosaic Band to match existing - Assuming 8" high	46	LF	120	5,520
43	Concrete cove to match existing	46	LF	20	920
44	Interior Wall Finish - Paint	460	SF	5	2,300
45	Allow for Misc. floor & ceiling finishes	240	SF	15	3,600
46	Allow for 4" thick concrete pads for equipment	60	SF	20	1,200
47	Allowance for Mechanical Scope	1	LS	40,000	40,000
48	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
49	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
50	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
52	Automatic Platform Gates [APGs] - 4'-6" High				
53	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
54	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	10,500	630,000
55	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
56	Platform End Gates (PEGs)	4	EA	13,000	52,000
57	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
58	Spare Parts - Approx. 10% of Material Cost	1	LS	202,170	202,170
59	Testing and commissioning	800	HRS	160	127,944
60	Product Warranty	1	LS	1,000,000	1,000,000
61	Allowance for Braille Signage	64	EA	2,500	160,000
62					
63	Electrical				
64	Electrical Upgrades				
65	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
66	Power and Lighting				
67	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
68	Allow for conduit / cable runs for power and communications under platform edge	1,080	LF	60	64,800
	PSD Connections	1	LS	75,000	75,000
70	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
71	Power to PSD Room from EDR including track crossing if needed	500	LF	60	30,000
72	Reserve power to PSD Room from EDR including track crossing if needed	500	LF	60	30,000
73	Reference Tier 2/3 Report [Page 1 of 9], No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
74	Grounding				
75	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
76	MISC				
77	Testing and commissioning	1	LS	30,000	30,000
78	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
79					
80	Communications				
81	FA System				
82	Scope in connection with Fire Alarm System	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: 8TH AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
83	CCTV coverage				
84	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
85	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
86	Berthing Technology Sensors				
87	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
88	Train Door Detection System				
89	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
90	Entrapment concerns				
91	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
92	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
93	Engineering and Testing	2,000	Hrs	160	319,860
94	Centralized monitoring/control				
95	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
96	MISC				
97	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
98	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
99	Site Survey and Inspections	1	LS	100,000	100,000
100	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
101	Furnish Test Equipment allowance	1	LS	500,000	500,000
102	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
103					
104	Out of hours Work				
105	No allowance included for work outside normal working hours		Note		EXCL.
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Allow loss of production to work at night say 50%	1	LS	3,421,331	3,421,331
112	TOTAL PSD WORK:				$ 14,825,767

114					
115	ADD ALTERNATIVE				
116					
117	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
118					
119	ADD				
120	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
121	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	15,000	900,000

22-Jun-18

STATION: 8TH AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
122	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
123	Platform End Gates (PEGs)	4	EA	18,000	72,000
124	Fixed Panels including framing and support; Assuming 8'-0" high	4,880	SF	750	3,660,282
125	Spare Parts - Approx. 10% of Material Cost	1	LS	377,537	377,537
126	Structual framing / bracing				
127	HSS4x4x1/2 hanger	4.1	TONS	17,500	71,858
128	L6x6x1/2 continuous angle	7.9	TONS	17,500	139,104
129	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
	Platform Edge Repair				
131	Remove 3' wide section of 3" deep structural slab to platform edge				N/A
132	Replace platform edge; Approx. 3'-0" wide x 6" minimum depth at cantilever edge				N/A
133	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				N/A
134					
135	OMIT				
136	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	-64	EA	15,000	(960,000)
137	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #22 per Platform	-60	EA	10,500	(630,000)
138	Double egress/service gate in the center of the platform; #1 per Platform	-2	EA	20,000	(40,000)
139	Platform End Gates (PEGs)	-4	EA	13,000	(52,000)
140	Fixed Panels including framing and support; 4'-6" High	-2,250	SF	750	(1,687,500)
141	Spare Parts - Approx. 10% of Material Cost	-1	LS	202,170	(202,170)
142	Platform Edge Reconstruction work	-1	LS	461,060	(461,060)
143	Remove allowance for cast in sleeves for LV & HV power	-256	EA	110	(28,160)
144	Conduit running under Platform Edge	-1,080	LF	30	(32,400)
145					
146	Allow loss of production to work at night say 50%	1	LS	862,686	862,686
147					
148	PREMIUM ASSOCIATED WITH PSD's				3,738,305

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: 1ST AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	500	LF		
5	LENGTH OF THE PLATFORM EDGE [CANARSIE BOUND] =	505	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,005	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,005	LF	7	7,035
13	Remove 5' wide section of 3" deep structural slab to platform edge	5,025	SF	12	60,300
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	94	CY	2,500	235,000
16	Pair of dowels (front & rear) cast into existing at 12" O.C	2,014	EA	25	50,350
17	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
18	Polyethylene edge strip	1,005	LF	95	95,475
19	Provide sleeves for HV & LV wires	256	EA	110	28,160
20					
21	Platform edge finishes				
22	Demolition				
23	Remove existing tactile warning strip 2' wide	1,005	LF	15	15,075
24	Remove existing platform tiles	1,005	LF	12	12,060
25	Sawcut existing topping concrete at perimeter of removal area	1,005	LF	5	5,025
26	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,030	SF	8	48,240
27	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 20' wide strip at ADA boarding area	1,120	SF	8	8,960
28	New Work				
29	New concrete topping to match existing	1,005	SF	15	15,075
30	New concrete topping at ADA boarding area to match existing	1,120	SF	15	16,800
31	Tactile Warning Strip - 2' wide strip along platform edge at door openings only (#32) & Platform end gates	384	LF	110	42,240
32	Misc. patchwork	1	LS	50,000	50,000
33					
34	Equipment Room [8'-0" x 30'-0"]				
35	Build off existing platform slab		Note		
36	Form 8" wide concrete curb including dowelling to platform slab	46	LF	90	4,140
37	CMU Wall for equipment room	460	SF	45	20,700
38	Vertical connections with existing structure	20	LF	25	500
39	Fire rated door including frame & hardware	1	EA	2,500	2,500
40	Exterior wall finish				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: 1ST AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
41	Ceramic Tiling to match existing	460	SF	40	18,400
42	Mosaic Band to match existing - Assuming 8" high	46	LF	120	5,520
43	Concrete cove to match existing	46	LF	20	920
44	Interior Wall Finish - Paint	460	SF	5	2,300
45	Allow for Misc. floor & ceiling finishes	240	SF	15	3,600
46	Allow for 4" thick concrete pads for equipment	60	SF	20	1,200
47	Allowance for Mechanical Scope	1	LS	40,000	40,000
48	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
49	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
50	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
52	**Automatic Platform Gates [APGs] - 4'-6" High**				
53	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
54	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	10,500	630,000
55	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
56	Platform End Gates (PEGs)	4	EA	13,000	52,000
57	Fixed Panels including framing and support; 4'-6" High	1,913	SF	750	1,434,375
58	Spare Parts - Approx. 10% of Material Cost	1	LS	186,983	186,983
59	Testing and commissioning	800	HRS	160	127,944
60	Product Warranty	1	LS	1,000,000	1,000,000
61	Allowance for Braille Signage	64	EA	2,500	160,000
62					
63	**Electrical**				
64	Electrical Upgrades				
65	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
66	Power and Lighting				
67	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
68	Allow for conduit / cable runs for power and communications under platform edge	1,005	LF	60	60,300
69	PSD Connections	1	LS	75,000	75,000
70	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
71	Power to PSD Room from EDR including track crossing if needed	500	LF	60	30,000
72	Reserve power to PSD Room from EDR including track crossing if needed	500	LF	60	30,000
73	Reference Tier 2/3 Report [Page 1 of 9], No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
74	Grounding				
75	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
76	MISC				
77	Testing and commissioning	1	LS	30,000	30,000
78	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
79					

22-Jun-18

STATION: 1ST AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
80	Communications				
81	FA System				
82	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
83	CCTV coverage				
84	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
85	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
86	Berthing Technology Sensors				
87	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
88	Train Door Detection System				
89	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
90	Entrapment concerns				
91	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
92	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
93	Engineering and Testing	2,000	Hrs	160	319,860
94	Centralized monitoring/control				
95	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
96	MISC				
97	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
98	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
99	Site Survey and Inspections	1	LS	100,000	100,000
100	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
101	Furnish Test Equipment allowance	1	LS	500,000	500,000
102	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
103					
104	Out of hours Work				
105	No allowance included for work outside normal working hours		Note		EXCL.
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Allow loss of production to work at night say 50%	1	LS	3,328,080	3,328,080
112	TOTAL PSD WORK:				$ 14,421,679

114					
115	ADD ALTERNATIVE				
116					
117	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
118					
119	ADD				
120	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: 1ST AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
121	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	15,000	900,000
122	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
123	Platform End Gates (PEGs)	4	EA	18,000	72,000
124	Fixed Panels including framing and support; Assuming 8'-0" high	4,280	SF	750	3,210,282
125	Spare Parts - Approx. 10% of Material Cost	1	LS	350,537	350,537
126	Structual framing / bracing				
127	HSS4x4x1/2 hanger	3.8	TONS	17,500	66,959
128	L6x6x1/2 continuous angle	7.4	TONS	17,500	129,444
129	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
	Platform Edge Repair				
131	Remove 3' wide section of 3" deep structural slab to platform edge	1,005	LF	27	27,135
132	Replace platform edge; Approx. 3'-0" wide x 6" minimum depth at cantilever edge	1,005	LF	109	109,545
133	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	1,128	EA	10	11,280
134					
135	OMIT				
136	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	-64	EA	15,000	(960,000)
137	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #22 per Platform	-60	EA	10,500	(630,000)
138	Double egress/service gate in the center of the platform; #1 per Platform	-2	EA	20,000	(40,000)
139	Platform End Gates (PEGs)	-4	EA	13,000	(52,000)
140	Fixed Panels including framing and support; 4'-6" High	-1,913	SF	750	(1,434,375)
141	Spare Parts - Approx. 10% of Material Cost	-1	LS	186,983	(186,983)
142	Platform Edge Reconstruction work	-1	LS	437,810	(437,810)
143	Remove allowance for cast in sleeves for LV & HV power	-256	EA	110	(28,160)
144	Conduit running under Platform Edge	-1,005	LF	30	(30,150)
145					
146	Allow loss of production to work at night say 50%	1	LS	847,750	847,750
147					
148	PREMIUM ASSOCIATED WITH PSD's				3,673,582

22-Jun-18

STATION: GRAHAM AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	540	LF		
5	LENGTH OF THE PLATFORM EDGE [CANARSIE BOUND] =	540	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,080	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,080	LF	7	7,560
13	Remove 5' wide section of 3" deep structural slab to platform edge	5,400	SF	12	64,800
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	100	CY	2,500	250,000
16	Pair of dowels (front & rear) cast into existing at 12" O.C	2,164	EA	25	54,100
17	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
18	Polyethylene edge strip	1,080	LF	95	102,600
19	Provide sleeves for HV & LV wires	256	EA	110	28,160
20					
21	Platform edge finishes				
22	Demolition				
23	Remove existing tactile warning strip 2' wide	1,080	LF	15	16,200
24	Remove existing platform tiles	1,080	LF	12	12,960
25	Sawcut existing topping concrete at perimeter of removal area	1,080	LF	5	5,400
26	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,480	SF	8	51,840
27	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 9'-10" and 9'-11" wide strip	316	SF	8	2,528
28	New Work				
29	New concrete topping to match existing	1,080	SF	15	16,200
30	New concrete topping at ADA boarding area to match existing	316	SF	15	4,740
31	Tactile Warning Strip - 2' wide strip along platform edge at door openings only (#32) & Platform end gates	384	LF	110	42,240
32	Misc. patchwork	1	LS	50,000	50,000
33					
34	Equipment Room				
35	Manhattan Bound [7'-0" x 17'-0"]				
36	Build off existing platform slab		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	31	LF	90	2,790
38	CMU Wall for equipment room	310	SF	45	13,950
39	Vertical connections with existing structure	20	LF	25	500
40	Fire rated door including frame & hardware	1	EA	2,500	2,500
41	Exterior wall finish				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: GRAHAM AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
42	Ceramic Tiling to match existing	310	SF	40	12,400
43	Mosaic Band to match existing - Assuming 8" high	31	LF	120	3,720
44	Concrete cove to match existing	31	LF	20	620
45	Interior Wall Finish - Paint	310	SF	5	1,550
46	Allow for Misc. floor & ceiling finishes	119	SF	15	1,785
47	Allow for 4" thick concrete pads for equipment	30	SF	20	595
48	Allowance for Mechanical Scope	1	LS	40,000	40,000
49	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
50	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
51	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
52	Canarsie Bound [7'-0" x 17'-0"]				
53	Build off existing platform slab		Note		
54	Form 8" wide concrete curb including dowelling to platform slab	31	LF	90	2,790
55	CMU Wall for equipment room	310	SF	45	13,950
56	Vertical connections with existing structure	20	LF	25	500
57	Fire rated door including frame & hardware	1	EA	2,500	2,500
58	Exterior wall finish				
59	Ceramic Tiling to match existing	310	SF	40	12,400
60	Mosaic Band to match existing - Assuming 8" high	31	LF	120	3,720
61	Concrete cove to match existing	31	LF	20	620
62	Interior Wall Finish - Paint	310	SF	5	1,550
63	Allow for Misc. floor & ceiling finishes	119	SF	15	1,785
64	Allow for 4" thick concrete pads for equipment	30	SF	20	595
65	Allowance for Mechanical Scope	1	LS	40,000	40,000
66	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
67	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
68	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
70	Automatic Platform Gates [APGs] - 4'-6" High				
71	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
72	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	10,500	630,000
73	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
74	Platform End Gates (PEGs)	4	EA	13,000	52,000
75	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
76	Spare Parts - Approx. 10% of Material Cost	1	LS	202,170	202,170
77	Testing and commissioning	800	HRS	160	127,944
78	Product Warranty	1	LS	1,000,000	1,000,000
79	Allowance for Braille Signage	64	EA	2,500	160,000
80					
81	Electrical				
82	Electrical Upgrades				
83	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
84	Power and Lighting				
85	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

STATION: GRAHAM AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
86	Allow for conduit / cable runs for power and communications under platform edge	1,080	LF	60	64,800
	PSD Connections	1	LS	75,000	75,000
88	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
89	Power to PSD Room from EDR including track crossing if needed	1,100	LF	60	66,000
90	Reserve power to PSD Room from EDR including track crossing if needed	1,200	LF	60	72,000
91	Reference Tier 2/3 Report [Page 1 of 9], No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
92	Grounding				
93	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
94	MISC				
95	Testing and commissioning	1	LS	30,000	30,000
96	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
97					
98	Communications				
99	FA System				
100	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
101	CCTV coverage				
102	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
103	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
104	Berthing Technology Sensors				
105	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
106	Train Door Detection System				
107	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
108	Entrapment concerns				
109	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
110	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
111	Engineering and Testing	2,000	Hrs	160	319,860
112	Centralized monitoring/control				
113	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
114	MISC				
115	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
116	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
117	Site Survey and Inspections	1	LS	100,000	100,000
118	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
119	Furnish Test Equipment allowance	1	LS	500,000	500,000
120	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
121					

STATION: GRAHAM AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
122	Out of hours Work				
123	No allowance included for work outside normal working hours		Note		EXCL.
124					
125	Training				
126	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
127					
128	Allow loss of production to work at night say 50%	1	LS	3,509,995	3,509,995
130	TOTAL PSD WORK:				$ 15,209,980

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
132					
133	ADD ALTERNATIVE				
134					
135	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
136					
137	ADD				
138	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
139	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	15,000	900,000
140	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
141	Platform End Gates (PEGs)	4	EA	18,000	72,000
142	Fixed Panels including framing and support; Assuming 8'-0" high	4,880	SF	750	3,660,282
143	Spare Parts - Approx. 10% of Material Cost	1	LS	377,537	377,537
144	Structual framing / bracing				
145	HSS4x4x1/2 hanger	4.1	TONS	17,500	71,858
146	L6x6x1/2 continuous angle	7.9	TONS	17,500	139,104
147	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
	Platform Edge Repair				-
149	Remove 3' wide section of 3" deep structural slab to platform edge	1,080	LF	27	29,160
150	Replace platform edge; Approx. 3'-0" wide x 6" minimum depth at cantilever edge	1,080	LF	109	117,720
151	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	1,128	EA	10	11,280
152					
153	OMIT				
154	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	-64	EA	15,000	(960,000)
155	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #22 per Platform	-60	EA	10,500	(630,000)
156	Double egress/service gate in the center of the platform; #1 per Platform	-2	EA	20,000	(40,000)
157	Platform End Gates (PEGs)	-4	EA	13,000	(52,000)
158	Fixed Panels including framing and support; 4'-6" High	-2,250	SF	750	(1,687,500)
159	Spare Parts - Approx. 10% of Material Cost	-1	LS	202,170	(202,170)
160	Platform Edge Reconstruction work	-1	LS	461,060	(461,060)
161	Remove allowance for cast in sleeves for LV & HV power	-256	EA	110	(28,160)
162	Conduit running under Platform Edge	-1,080	LF	30	(32,400)
163					
164	Allow loss of production to work at night say 50%	1	LS	910,134	910,134
165					
166					
167	PREMIUM ASSOCIATED WITH PSD's				3,943,913

22-Jun-18

STATION: GRAND STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	540	LF		
5	LENGTH OF THE PLATFORM EDGE [CANARSIE BOUND] =	540	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,080	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,080	LF	7	7,560
13	Remove 5' wide section of 3" deep structural slab to platform edge	5,400	SF	12	64,800
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	100	CY	2,500	250,000
16	Pair of dowels (front & rear) cast into existing at 12" O.C	2,164	EA	25	54,100
17	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
18	Polyethylene edge strip	1,080	LF	95	102,600
19	Provide sleeves for HV & LV wires	256	EA	110	28,160
20					
21	Platform edge finishes				
22	Demolition				
23	Remove existing tactile warning strip 2' wide	1,080	LF	15	16,200
24	Remove existing platform tiles	1,080	LF	12	12,960
25	Sawcut existing topping concrete at perimeter of removal area	1,080	LF	5	5,400
26	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,480	SF	8	51,840
27	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 9'-10" and 9'-11" wide strip	316	SF	8	2,528
28	New Work				
29	New concrete topping to match existing	1,080	SF	15	16,200
30	New concrete topping at ADA boarding area to match existing	316	SF	15	4,740
31	Tactile Warning Strip - 2' wide strip along platform edge at door openings only (#32) & Platform end gates	384	LF	110	42,240
32	Misc. patchwork	1	LS	50,000	50,000
33					
34	Equipment Room				
35	Manhattan Bound [7'-0" x 17'-0"]				
36	Build off existing platform slab		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	24	LF	90	2,160
38	CMU Wall for equipment room	240	SF	45	10,800
39	Vertical connections with existing structure	20	LF	25	500
40	Fire rated door including frame & hardware	1	EA	2,500	2,500
41	Exterior wall finish				

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: GRAND STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
42	Ceramic Tiling to match existing	240	SF	40	9,600
43	Mosaic Band to match existing - Assuming 8" high	24	LF	120	2,880
44	Concrete cove to match existing	24	LF	20	480
45	Interior Wall Finish - Paint	240	SF	5	1,200
46	Allow for Misc. floor & ceiling finishes	119	SF	15	1,785
47	Allow for 4" thick concrete pads for equipment	30	SF	20	595
48	Allowance for Mechanical Scope	1	LS	40,000	40,000
49	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
50	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
51	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
52	Canarsie Bound [7'-0" x 17'-0"]				
53	Build off existing platform slab		Note		
54	Form 8" wide concrete curb including dowelling to platform slab	24	LF	90	2,160
55	CMU Wall for equipment room	240	SF	45	10,800
56	Vertical connections with existing structure	20	LF	25	500
57	Fire rated door including frame & hardware	1	EA	2,500	2,500
58	Exterior wall finish				
59	Ceramic Tiling to match existing	240	SF	40	9,600
60	Mosaic Band to match existing - Assuming 8" high	24	LF	120	2,880
61	Concrete cove to match existing	24	LF	20	480
62	Interior Wall Finish - Paint	240	SF	5	1,200
63	Allow for Misc. floor & ceiling finishes	119	SF	15	1,785
64	Allow for 4" thick concrete pads for equipment	30	SF	20	595
65	Allowance for Mechanical Scope	1	LS	40,000	40,000
66	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
67	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
68	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
70	Automatic Platform Gates [APGs] - 4'-6" High				
71	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
72	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	10,500	630,000
73	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
74	Platform End Gates (PEGs)	4	EA	13,000	52,000
75	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
76	Spare Parts - Approx. 10% of Material Cost	1	LS	202,170	202,170
77	Testing and commissioning	800	HRS	160	127,944
78	Product Warranty	1	LS	1,000,000	1,000,000
79	Allowance for Braille Signage	64	EA	2,500	160,000
80					
81	Electrical				
82	Electrical Upgrades				
83	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
84	Power and Lighting				
85	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

STATION: GRAND STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
86	Allow for conduit / cable runs for power and communications under platform edge	1,080	LF	60	64,800
	PSD Connections	1	LS	75,000	75,000
88	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
89	Power to PSD Room from EDR including track crossing if needed	1,100	LF	60	66,000
90	Reserve power to PSD Room from EDR including track crossing if needed	1,200	LF	60	72,000
91	Reference Tier 2/3 Report [Page 1 of 9], No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
92	Grounding				
93	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
94	MISC				
95	Testing and commissioning	1	LS	30,000	30,000
96	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
97					
98	Communications				
99	FA System				
100	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
101	CCTV coverage				
102	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
103	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
104	Berthing Technology Sensors				
105	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
106	Train Door Detection System				
107	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
108	Entrapment concerns				
109	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
110	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
111	Engineering and Testing	2,000	Hrs	160	319,860
112	Centralized monitoring/control				
113	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
114	MISC				
115	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
116	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
117	Site Survey and Inspections	1	LS	100,000	100,000
118	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
119	Furnish Test Equipment allowance	1	LS	500,000	500,000

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STATION: GRAND STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
120	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
121					
122	Out of hours Work				
123	No allowance included for work outside normal working hours		Note		EXCL.
124					
125	Training				
126	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
127					
128	Allow loss of production to work at night say 50%	1	LS	3,505,249	3,505,249
130	TOTAL PSD WORK:				$ 15,189,414

132					
133	ADD ALTERNATIVE				
134					
135	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
136					
137	ADD				
138	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
139	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	15,000	900,000
140	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
141	Platform End Gates (PEGs)	4	EA	18,000	72,000
142	Fixed Panels including framing and support; Assuming 8'-0" high	4,880	SF	750	3,660,282
143	Spare Parts - Approx. 10% of Material Cost	1	LS	377,537	377,537
144	Structual framing / bracing				
145	HSS4x4x1/2 hanger	4.1	TONS	17,500	71,858
146	L6x6x1/2 continuous angle	7.9	TONS	17,500	139,104
147	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
	Platform Edge Repair				-
149	Remove 3' wide section of 3" deep structural slab to platform edge	1,080	LF	27	29,160
150	Replace platform edge; Approx. 3'-0" wide x 6" minimum depth at cantilever edge	1,080	LF	109	117,720
151	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	1,128	EA	10	11,280
152					
153	OMIT				
154	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	-64	EA	15,000	(960,000)
155	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #22 per Platform	-60	EA	10,500	(630,000)
156	Double egress/service gate in the center of the platform; #1 per Platform	-2	EA	20,000	(40,000)
157	Platform End Gates (PEGs)	-4	EA	13,000	(52,000)
158	Fixed Panels including framing and support; 4'-6" High	-2,250	SF	750	(1,687,500)
159	Spare Parts - Approx. 10% of Material Cost	-1	LS	202,170	(202,170)
160	Platform Edge Reconstruction work	-1	LS	461,060	(461,060)
161	Remove allowance for cast in sleeves for LV & HV power	-256	EA	110	(28,160)
162	Conduit running under Platform Edge	-1,080	LF	30	(32,400)
163					
164	Allow loss of production to work at night say 50%	1	LS	910,134	910,134
165					
166	PREMIUM ASSOCIATED WITH PSD's				3,943,913

STATION: MONTROSE AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	540	LF		
5	LENGTH OF THE PLATFORM EDGE [CANARSIE BOUND] =	540	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,080	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,080	LF	7	7,560
13	Remove 5' wide section of 3" deep structural slab to platform edge	5,400	SF	12	64,800
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	100	CY	2,500	250,000
16	Pair of dowels (front & rear) cast into existing at 12" O.C	2,164	EA	25	54,100
17	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
18	Polyethylene edge strip	1,080	LF	95	102,600
19	Provide sleeves for HV & LV wires	256	EA	110	28,160
20					
21	Platform edge finishes				
22	Demolition				
23	Remove existing tactile warning strip 2' wide	1,080	LF	15	16,200
24	Remove existing platform tiles	1,080	LF	12	12,960
25	Sawcut existing topping concrete at perimeter of removal area	1,080	LF	5	5,400
26	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,480	SF	8	51,840
27	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 11'-10" wide strip	466	SF	8	3,731
28	New Work				
29	New concrete topping to match existing	1,080	SF	15	16,200
30	New concrete topping at ADA boarding area to match existing	466	SF	15	6,996
31	Tactile Warning Strip - 2' wide strip along platform edge at door openings only (#32) & Platform end gates	384	LF	110	42,240
32	Misc. patchwork	1	LS	50,000	50,000
33					
34	Equipment Room				
35	Mezzanine Level [12'-0" x 16'-0"]				
36	Build off existing platform slab		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	44	LF	90	3,960
38	CMU Wall for equipment room	440	SF	45	19,800
39	Vertical connections with existing structure	20	LF	25	500
40	Fire rated door including frame & hardware	1	EA	2,500	2,500
41	Exterior wall finish				

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STATION: MONTROSE AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
42	Ceramic Tiling to match existing	440	SF	40	17,600
43	Mosaic Band to match existing - Assuming 8" high	44	LF	120	5,280
44	Concrete cove to match existing	44	LF	20	880
45	Interior Wall Finish - Paint	440	SF	5	2,200
46	Allow for Misc. floor & ceiling finishes	192	SF	15	2,880
47	Allow for 4" thick concrete pads for equipment	48	SF	20	960
48	Allowance for Mechanical Scope	1	LS	40,000	40,000
49	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
50	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
51	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
53	**Automatic Platform Gates [APGs] - 4'-6" High**				
54	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
55	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	10,500	630,000
56	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
57	Platform End Gates (PEGs)	4	EA	13,000	52,000
58	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
59	Spare Parts - Approx. 10% of Material Cost	1	LS	202,170	202,170
60	Testing and commissioning	800	HRS	160	127,944
61	Product Warranty	1	LS	1,000,000	1,000,000
62	Allowance for Braille Signage	64	EA	2,500	160,000
63					
64	**Electrical**				
65	Electrical Upgrades				
66	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
67	Power and Lighting				
68	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
69	Allow for conduit / cable runs for power and communications under platform edge	1,080	LF	60	64,800
	PSD Connections	1	LS	75,000	75,000
71	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
72	Power to PSD Room from EDR including track crossing if needed	650	LF	60	39,000
73	Reserve power to PSD Room from EDR including track crossing if needed	700	LF	60	42,000
74	Reference Tier 2/3 Report [Page 1 of 9], No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
75	Grounding				
76	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
77	MISC				
78	Testing and commissioning	1	LS	30,000	30,000
79	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
80					
81	**Communications**				
82	FA System				
83	Scope in connection with Fire Alarm System	1	LS	100,000	100,000

22-Jun-18

STATION: MONTROSE AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
84	CCTV coverage				
85	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
86	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
87	Berthing Technology Sensors				
88	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
89	Train Door Detection System				
90	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
91	Entrapment concerns				
92	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
93	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
94	Engineering and Testing	2,000	Hrs	160	319,860
95	Centralized monitoring/control				
96	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
97	MISC				
98	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
99	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
100	Site Survey and Inspections	1	LS	100,000	100,000
101	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
102	Furnish Test Equipment allowance	1	LS	500,000	500,000
103	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
104					
105	Out of hours Work				
106	No allowance included for work outside normal working hours		Note		EXCL.
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Allow loss of production to work at night say 50%	1	LS	3,422,155	3,422,155
113	TOTAL PSD WORK:				$ 14,829,339

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
122	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	15,000	900,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: MONTROSE AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,880	SF	750	3,660,282
126	Spare Parts - Approx. 10% of Material Cost	1	LS	377,537	377,537
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4.1	TONS	17,500	71,858
129	L6x6x1/2 continuous angle	7.9	TONS	17,500	139,104
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
	Platform Edge Repair				-
132	Remove 3' wide section of 3" deep structural slab to platform edge	1,080	LF	27	29,160
133	Replace platform edge; Approx. 3'-0" wide x 6" minimum depth at cantilever edge	1,080	LF	109	117,720
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	1,128	EA	10	11,280
135					
136	OMIT				
137	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	-64	EA	15,000	(960,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #22 per Platform	-60	EA	10,500	(630,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	-2	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	-4	EA	13,000	(52,000)
141	Fixed Panels including framing and support; 4'-6" High	-2,250	SF	750	(1,687,500)
142	Spare Parts - Approx. 10% of Material Cost	-1	LS	202,170	(202,170)
143	Platform Edge Reconstruction work	-1	LS	461,060	(461,060)
144	Remove allowance for cast in sleeves for LV & HV power	-256	EA	110	(28,160)
145	Conduit running under Platform Edge	-1,080	LF	30	(32,400)
146					
147	Allow loss of production to work at night say 50%	1	LS	910,134	910,134
148					
149	PREMIUM ASSOCIATED WITH PSD's				3,943,913

STATION: MORGAN AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	540	LF		
5	LENGTH OF THE PLATFORM EDGE [CANARSIE BOUND] =	540	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,080	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,080	LF	7	7,560
13	Remove 5' wide section of 3" deep structural slab to platform edge	5,400	SF	12	64,800
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	100	CY	2,500	250,000
16	Pair of dowels (front & rear) cast into existing at 12" O.C	2,164	EA	25	54,100
17	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
18	Polyethylene edge strip	1,080	LF	95	102,600
19	Provide sleeves for HV & LV wires	256	EA	110	28,160
20					
21	Platform edge finishes				
22	Demolition				
23	Remove existing tactile warning strip 2' wide	1,080	LF	15	16,200
24	Remove existing platform tiles	1,080	LF	12	12,960
25	Sawcut existing topping concrete at perimeter of removal area	1,080	LF	5	5,400
26	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,480	SF	8	51,840
27	Remove existing 3" concrete topping at 40' long ADA boarding area; Assuming balance of platform width i.e. 12' wide strip	480	SF	8	3,840
28	New Work				
29	New concrete topping to match existing	1,080	SF	15	16,200
30	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
31	Tactile Warning Strip - 2' wide strip along platform edge at door openings only (#32) & Platform end gates	384	LF	110	42,240
32	Misc. patchwork	1	LS	50,000	50,000
33					
34	Equipment Room [8'-0" x 30'-0"]				
35	Build off existing platform slab		Note		
36	Form 8" wide concrete curb including dowelling to platform slab	38	LF	90	3,420
37	CMU Wall for equipment room	380	SF	45	17,100
38	Vertical connections with existing structure	20	LF	25	500
39	Fire rated door including frame & hardware	1	EA	2,500	2,500
40	Exterior wall finish				

22-Jun-18

STATION: MORGAN AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
41	Ceramic Tiling to match existing	380	SF	40	15,200
42	Mosaic Band to match existing - Assuming 8" high	38	LF	120	4,560
43	Concrete cove to match existing	38	LF	20	760
44	Interior Wall Finish - Paint	380	SF	5	1,900
45	Allow for Misc. floor & ceiling finishes	240	SF	15	3,600
46	Allow for 4" thick concrete pads for equipment	60	SF	20	1,200
47	Allowance for Mechanical Scope	1	LS	40,000	40,000
48	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
49	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
50	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
52	**Automatic Platform Gates [APGs] - 4'-6" High**				
53	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
54	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	10,500	630,000
55	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
56	Platform End Gates (PEGs)	4	EA	13,000	52,000
57	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
58	Spare Parts - Approx. 10% of Material Cost	1	LS	202,170	202,170
59	Testing and commissioning	800	HRS	160	127,944
60	Product Warranty	1	LS	1,000,000	1,000,000
61	Allowance for Braille Signage	64	EA	2,500	160,000
62					
63	**Electrical**				
64	Electrical Upgrades				
65	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
66	Power and Lighting				
67	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
68	Allow for conduit / cable runs for power and communications under platform edge	1,080	LF	60	64,800
	PSD Connections	1	LS	75,000	75,000
70	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
71	Power to PSD Room from EDR including track crossing if needed	550	LF	60	33,000
72	Reserve power to PSD Room from EDR including track crossing if needed	600	LF	60	36,000
73	Reference Tier 2/3 Report [Page 1 of 9], No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
74	Grounding				
75	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
76	MISC				
77	Testing and commissioning	1	LS	30,000	30,000
78	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
79					
80	**Communications**				
81	FA System				

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STATION: MORGAN AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
82	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
83	CCTV coverage				
84	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
85	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
86	Berthing Technology Sensors				
87	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
88	Train Door Detection System				
89	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
90	Entrapment concerns				
91	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
92	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
93	Engineering and Testing	2,000	Hrs	160	319,860
94	Centralized monitoring/control				
95	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
96	MISC				
97	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
98	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
99	Site Survey and Inspections	1	LS	100,000	100,000
100	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
101	Furnish Test Equipment allowance	1	LS	500,000	500,000
102	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
103					
104	Out of hours Work				
105	No allowance included for work outside normal working hours		Note		EXCL.
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Allow loss of production to work at night say 50%	1	LS	3,416,903	3,416,903
112	TOTAL PSD WORK:				$ 14,806,579

114					
115	ADD ALTERNATIVE				
116					
117	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
118					
119	ADD				
120	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000

22-Jun-18

STATION: MORGAN AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
121	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	15,000	900,000
122	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
123	Platform End Gates (PEGs)	4	EA	18,000	72,000
124	Fixed Panels including framing and support; Assuming 8'-0" high	4,880	SF	750	3,660,282
125	Spare Parts - Approx. 10% of Material Cost	1	LS	377,537	377,537
126	Structual framing / bracing				
127	HSS4x4x1/2 hanger	4.1	TONS	17,500	71,858
128	L6x6x1/2 continuous angle	7.9	TONS	17,500	139,104
129	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
	Platform Edge Repair				-
131	Remove 3' wide section of 3" deep structural slab to platform edge	1,080	LF	27	29,160
132	Replace platform edge; Approx. 3'-0" wide x 6" minimum depth at cantilever edge	1,080	LF	109	117,720
133	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	1,128	EA	10	11,280
134					
135	OMIT				
136	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	-64	EA	15,000	(960,000)
137	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #22 per Platform	-60	EA	10,500	(630,000)
138	Double egress/service gate in the center of the platform; #1 per Platform	-2	EA	20,000	(40,000)
139	Platform End Gates (PEGs)	-4	EA	13,000	(52,000)
140	Fixed Panels including framing and support; 4'-6" High	-2,250	SF	750	(1,687,500)
141	Spare Parts - Approx. 10% of Material Cost	-1	LS	202,170	(202,170)
142	Platform Edge Reconstruction work	-1	LS	461,060	(461,060)
143	Remove allowance for cast in sleeves for LV & HV power	-256	EA	110	(28,160)
144	Conduit running under Platform Edge	-1,080	LF	30	(32,400)
145					
146	Allow loss of production to work at night say 50%	1	LS	910,134	910,134
147					
148	PREMIUM ASSOCIATED WITH PSD's				3,943,913

22-Jun-18

STATION: JEFFERSON AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	540	LF		
5	LENGTH OF THE PLATFORM EDGE [CANARSIE BOUND] =	540	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,080	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,080	LF	7	7,560
13	Remove 5' wide section of 3" deep structural slab to platform edge	5,400	SF	12	64,800
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	100	CY	2,500	250,000
16	Pair of dowels (front & rear) cast into existing at 12" O.C	2,164	EA	25	54,100
17	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
18	Polyethylene edge strip	1,080	LF	95	102,600
19	Provide sleeves for HV & LV wires	256	EA	110	28,160
20					
21	Platform edge finishes				
22	Demolition				
23	Remove existing tactile warning strip 2' wide	1,080	LF	15	16,200
24	Remove existing platform tiles	1,080	LF	12	12,960
25	Sawcut existing topping concrete at perimeter of removal area	1,080	LF	5	5,400
26	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,480	SF	8	51,840
27	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12' wide strip	480	SF	8	3,840
28	New Work				
29	New concrete topping to match existing	1,080	SF	15	16,200
30	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
31	Tactile Warning Strip - 2' wide strip along platform edge at door openings only (#32) & Platform end gates	384	LF	110	42,240
32	Misc. patchwork	1	LS	50,000	50,000
33					
34	Equipment Room				
35	Mezzanine Level [7'-5" x 30'-0"]				
36	Build off existing platform slab		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	67	LF	90	6,068
38	CMU Wall for equipment room	674	SF	45	30,339
39	Vertical connections with existing structure	20	LF	25	500
40	Fire rated door including frame & hardware	1	EA	2,500	2,500
41	Exterior wall finish				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: JEFFERSON AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
42	Ceramic Tiling to match existing	674	SF	40	26,968
43	Mosaic Band to match existing - Assuming 8" high	67	LF	120	8,090
44	Concrete cove to match existing	67	LF	20	1,348
45	Interior Wall Finish - Paint	674	SF	5	3,371
46	Allow for Misc. floor & ceiling finishes	223	SF	15	3,339
47	Allow for 4" thick concrete pads for equipment	56	SF	20	1,113
48	Allowance for Mechanical Scope	1	LS	40,000	40,000
49	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
50	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
51	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
53	**Automatic Platform Gates [APGs] - 4'-6" High**				
54	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
55	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	10,500	630,000
56	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
57	Platform End Gates (PEGs)	4	EA	13,000	52,000
58	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
59	Spare Parts - Approx. 10% of Material Cost	1	LS	202,170	202,170
60	Testing and commissioning	800	HRS	160	127,944
61	Product Warranty	1	LS	1,000,000	1,000,000
62	Allowance for Braille Signage	64	EA	2,500	160,000
63					
64	**Electrical**				
65	Electrical Upgrades				
66	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
67	Power and Lighting				
68	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
69	Allow for conduit / cable runs for power and communications under platform edge	1,080	LF	60	64,800
	PSD Connections	1	LS	75,000	75,000
71	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
72	Power to PSD Room from EDR including track crossing if needed	650	LF	60	39,000
73	Reserve power to PSD Room from EDR including track crossing if needed	700	LF	60	42,000
74	Reference Tier 2/3 Report [Page 1 of 9], No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
75	Grounding				
76	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
77	MISC				
78	Testing and commissioning	1	LS	30,000	30,000
79	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
80					

STATION: JEFFERSON AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
81	Communications				
82	FA System				
83	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
84	CCTV coverage				
85	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
86	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
87	Berthing Technology Sensors				
88	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
89	Train Door Detection System				
90	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
91	Entrapment concerns				
92	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
93	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
94	Engineering and Testing	2,000	Hrs	160	319,860
95	Centralized monitoring/control				
96	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
97	MISC				
98	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
99	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
100	Site Survey and Inspections	1	LS	100,000	100,000
101	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
102	Furnish Test Equipment allowance	1	LS	500,000	500,000
103	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
104					
105	Out of hours Work				
106	No allowance included for work outside normal working hours		Note		EXCL.
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Allow loss of production to work at night say 50%	1	LS	3,430,372	3,430,372
113	TOTAL PSD WORK:				$ 14,864,945

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000

22-Jun-18

STATION: JEFFERSON AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
122	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	15,000	900,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,880	SF	750	3,660,282
126	Spare Parts - Approx. 10% of Material Cost	1	LS	377,537	377,537
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4.1	TONS	17,500	71,858
129	L6x6x1/2 continuous angle	7.9	TONS	17,500	139,104
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
	Platform Edge Repair				-
132	Remove 3' wide section of 3" deep structural slab to platform edge	1,080	LF	27	29,160
133	Replace platform edge; Approx. 3'-0" wide x 6" minimum depth at cantilever edge	1,080	LF	109	117,720
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	1,128	EA	10	11,280
135					
136	OMIT				
137	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	-64	EA	15,000	(960,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #22 per Platform	-60	EA	10,500	(630,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	-2	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	-4	EA	13,000	(52,000)
141	Fixed Panels including framing and support; 4'-6" High	-2,250	SF	750	(1,687,500)
142	Spare Parts - Approx. 10% of Material Cost	-1	LS	202,170	(202,170)
143	Platform Edge Reconstruction work	-1	LS	461,060	(461,060)
144	Remove allowance for cast in sleeves for LV & HV power	-256	EA	110	(28,160)
145	Conduit running under Platform Edge	-1,080	LF	30	(32,400)
146					
147	Allow loss of production to work at night say 50%	1	LS	910,134	910,134
148					
149	PREMIUM ASSOCIATED WITH PSD's				3,943,913

22-Jun-18

STATION: DEKALB AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	540	LF		
5	LENGTH OF THE PLATFORM EDGE [CANARSIE BOUND] =	540	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,080	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,080	LF	7	7,560
13	Remove 5' wide section of 3" deep structural slab to platform edge	5,400	SF	12	64,800
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	100	CY	2,500	250,000
16	Pair of dowels (front & rear) cast into existing at 12" O.C	2,164	EA	25	54,100
17	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
18	Polyethylene edge strip	1,080	LF	95	102,600
19	Provide sleeves for HV & LV wires	256	EA	110	28,160
20					
21	Platform edge finishes				
22	Demolition				
23	Remove existing tactile warning strip 2' wide	1,080	LF	15	16,200
24	Remove existing platform tiles	1,080	LF	12	12,960
25	Sawcut existing topping concrete at perimeter of removal area	1,080	LF	5	5,400
26	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,480	SF	8	51,840
27	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12' wide strip	480	SF	8	3,840
28	New Work				
29	New concrete topping to match existing	1,080	SF	15	16,200
30	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
31	Tactile Warning Strip - 2' wide strip along platform edge at door openings only (#32) & Platform end gates	384	LF	110	42,240
32	Misc. patchwork	1	LS	50,000	50,000
33					
34	Equipment Room [8'-0" x 30'-0"]				
35	Build off existing platform slab		Note		
36	Form 8" wide concrete curb including dowelling to platform slab	46	LF	90	4,140
37	CMU Wall for equipment room	460	SF	45	20,700
38	Vertical connections with existing structure	20	LF	25	500
39	Fire rated door including frame & hardware	1	EA	2,500	2,500
40	Exterior wall finish				
41	Ceramic Tiling to match existing	460	SF	40	18,400

22-Jun-18

STATION: DEKALB AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
42	Mosaic Band to match existing - Assuming 8" high	46	LF	120	5,520
43	Concrete cove to match existing	46	LF	20	920
44	Interior Wall Finish - Paint	460	SF	5	2,300
45	Allow for Misc. floor & ceiling finishes	240	SF	15	3,600
46	Allow for 4" thick concrete pads for equipment	60	SF	20	1,200
47	Allowance for Mechanical Scope	1	LS	40,000	40,000
48	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
49	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
50	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
52	Automatic Platform Gates [APGs] - 4'-6" High				
53	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
54	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	10,500	630,000
55	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
56	Platform End Gates (PEGs)	4	EA	13,000	52,000
57	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
58	Spare Parts - Approx. 10% of Material Cost	1	LS	202,170	202,170
59	Testing and commissioning	800	HRS	160	127,944
60	Product Warranty	1	LS	1,000,000	1,000,000
61	Allowance for Braille Signage	64	EA	2,500	160,000
62					
63	Electrical				
64	Electrical Upgrades				
65	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
66	Power and Lighting				
67	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
68	Allow for conduit / cable runs for power and communications under platform edge	1,080	LF	60	64,800
	PSD Connections	1	LS	75,000	75,000
70	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
71	Power to PSD Room from EDR including track crossing if needed	550	LF	60	33,000
72	Reserve power to PSD Room from EDR including track crossing if needed	600	LF	60	36,000
73	Reference Tier 2/3 Report [Page 1 of 9], No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
74	Grounding				
75	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
76	MISC				
77	Testing and commissioning	1	LS	30,000	30,000
78	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
79					
80	Communications				
81	FA System				
82	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
83	CCTV coverage				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: DEKALB AVENUE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
84	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
85	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
86	Berthing Technology Sensors				
87	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
88	Train Door Detection System				
89	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
90	Entrapment concerns				
91	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
92	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
93	Engineering and Testing	2,000	Hrs	160	319,860
94	Centralized monitoring/control				
95	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
96	MISC				
97	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
98	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
99	Site Survey and Inspections	1	LS	100,000	100,000
100	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
101	Furnish Test Equipment allowance	1	LS	500,000	500,000
102	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
103					
104	Out of hours Work				
105	No allowance included for work outside normal working hours		Note		EXCL.
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Allow loss of production to work at night say 50%	1	LS	3,419,615	3,419,615
112	TOTAL PSD WORK:				$ 14,818,331

114					
115	ADD ALTERNATIVE				
116					
117	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
118					
119	ADD				
120	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
121	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	15,000	900,000
122	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000

STATION: DEKALB AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
123	Platform End Gates (PEGs)	4	EA	18,000	72,000
124	Fixed Panels including framing and support; Assuming 8'-0" high	4,880	SF	750	3,660,282
125	Spare Parts - Approx. 10% of Material Cost	1	LS	377,537	377,537
126	Structual framing / bracing				
127	HSS4x4x1/2 hanger	4.1	TONS	17,500	71,858
128	L6x6x1/2 continuous angle	7.9	TONS	17,500	139,104
129	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
	Platform Edge Repair				-
131	Remove 3' wide section of 3" deep structural slab to platform edge	1,080	LF	27	29,160
132	Replace platform edge; Approx. 3'-0" wide x 6" minimum depth at cantilever edge	1,080	LF	109	117,720
133	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	1,128	EA	10	11,280
134					
135	OMIT				
136	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	-64	EA	15,000	(960,000)
137	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #22 per Platform	-60	EA	10,500	(630,000)
138	Double egress/service gate in the center of the platform; #1 per Platform	-2	EA	20,000	(40,000)
139	Platform End Gates (PEGs)	-4	EA	13,000	(52,000)
140	Fixed Panels including framing and support; 4'-6" High	-2,250	SF	750	(1,687,500)
141	Spare Parts - Approx. 10% of Material Cost	-1	LS	202,170	(202,170)
142	Platform Edge Reconstruction work	-1	LS	461,060	(461,060)
143	Remove allowance for cast in sleeves for LV & HV power	-256	EA	110	(28,160)
144	Conduit running under Platform Edge	-1,080	LF	30	(32,400)
145					
146	Allow loss of production to work at night say 50%	1	LS	910,134	910,134
147					
148					
149	PREMIUM ASSOCIATED WITH PSD's				3,943,913

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: MYRTLE-WYCKOFF AVENUES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	540	LF		
5	LENGTH OF THE PLATFORM EDGE [CANARSIE BOUND] =	540	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,080	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,080	LF	7	7,560
13	Remove 5' wide section of 3" deep structural slab to platform edge	5,400	SF	12	64,800
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	100	CY	2,500	250,000
16	Pair of dowels (front & rear) cast into existing at 12" O.C	2,164	EA	25	54,100
17	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
18	Polyethylene edge strip	1,080	LF	95	102,600
19	Provide sleeves for HV & LV wires	256	EA	110	28,160
20					
21	Platform edge finishes				
22	Demolition				
23	Remove existing tactile warning strip 2' wide	1,080	LF	15	16,200
24	Remove existing platform tiles	1,080	LF	12	12,960
25	Sawcut existing topping concrete at perimeter of removal area	1,080	LF	5	5,400
26	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,480	SF	8	51,840
27	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 20' wide strip	1,120	SF	8	8,960
28	New Work				
29	New concrete topping to match existing	1,080	SF	15	16,200
30	New concrete topping at ADA boarding area to match existing	1,120	SF	15	16,800
31	Tactile Warning Strip - 2' wide strip along platform edge at door openings only (#32) & Platform end gates	384	LF	110	42,240
32	Misc. patchwork	1	LS	50,000	50,000
33					
34	Equipment Room				
	Mezzanine Level [12'-0" x 16'-0"]				
36	Build off existing platform slab		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	40	LF	90	3,600
38	CMU Wall for equipment room	400	SF	45	18,000
39	Vertical connections with existing structure	20	LF	25	500
40	Fire rated door including frame & hardware	1	EA	2,500	2,500
41	Exterior wall finish				
42	Ceramic Tiling to match existing	400	SF	40	16,000
43	Mosaic Band to match existing - Assuming 8" high	40	LF	120	4,800
44	Concrete cove to match existing	40	LF	20	800

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: MYRTLE-WYCKOFF AVENUES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
45	Interior Wall Finish - Paint	400	SF	5	2,000
46	Allow for Misc. floor & ceiling finishes	144	SF	15	2,160
47	Allow for 4" thick concrete pads for equipment	36	SF	20	720
48	Allowance for Mechanical Scope	1	LS	40,000	40,000
49	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
50	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
51	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
53	**Automatic Platform Gates [APGs] - 4'-6" High**				
54	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
55	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	10,500	630,000
56	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
57	Platform End Gates (PEGs)	4	EA	13,000	52,000
58	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
59	Spare Parts - Approx. 10% of Material Cost	1	LS	202,170	202,170
60	Testing and commissioning	800	HRS	160	127,944
61	Product Warranty	1	LS	1,000,000	1,000,000
62	Allowance for Braille Signage	64	EA	2,500	160,000
63					
64	**Electrical**				
65	Electrical Upgrades				
66	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
67	Power and Lighting				
68	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
69	Allow for conduit / cable runs for power and communications under platform edge	1,080	LF	60	64,800
	PSD Connections	1	LS	75,000	75,000
71	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
72	Power to PSD Room from EDR including track crossing if needed	350	LF	60	21,000
73	Reserve power to PSD Room from EDR including track crossing if needed	350	LF	60	21,000
74	Reference Tier 2/3 Report [Page 1 of 9], No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
75	Grounding				
76	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
77	MISC				
78	Testing and commissioning	1	LS	30,000	30,000
79	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
80					

STATION: MYRTLE-WYCKOFF AVENUES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
81	Communications				
82	FA System				
83	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
84	CCTV coverage				
85	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
86	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
87	Berthing Technology Sensors				
88	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
89	Train Door Detection System				
90	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
91	Entrapment concerns				
92	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
93	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
94	Engineering and Testing	2,000	Hrs	160	319,860
95	Centralized monitoring/control				
96	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
97	MISC				
98	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
99	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
100	Site Survey and Inspections	1	LS	100,000	100,000
101	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
102	Furnish Test Equipment allowance	1	LS	500,000	500,000
103	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
104					
105	Out of hours Work				
106	No allowance included for work outside normal working hours		Note		EXCL.
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Allow loss of production to work at night say 50%	1	LS	3,413,321	3,413,321
112					
113	TOTAL PSD WORK:				$ 14,791,057

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
122	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	15,000	900,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: MYRTLE-WYCKOFF AVENUES

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,880	SF	750	3,660,282
126	Spare Parts - Approx. 10% of Material Cost	1	LS	377,537	377,537
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4.1	TONS	17,500	71,858
129	L6x6x1/2 continuous angle	7.9	TONS	17,500	139,104
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
	Platform Edge Repair				-
132	Remove 3' wide section of 3" deep structural slab to platform edge	1,080	LF	27	29,160
133	Replace platform edge; Approx. 3'-0" wide x 6" minimum depth at cantilever edge	1,080	LF	109	117,720
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	1,128	EA	10	11,280
135					
136	OMIT				
137	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	-64	EA	15,000	(960,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #22 per Platform	-60	EA	10,500	(630,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	-2	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	-4	EA	13,000	(52,000)
141	Fixed Panels including framing and support; 4'-6" High	-2,250	SF	750	(1,687,500)
142	Spare Parts - Approx. 10% of Material Cost	-1	LS	202,170	(202,170)
143	Platform Edge Reconstruction work	-1	LS	461,060	(461,060)
144	Remove allowance for cast in sleeves for LV & HV power	-256	EA	110	(28,160)
145	Conduit running under Platform Edge	-1,080	LF	30	(32,400)
147	Allow loss of production to work at night say 50%	1	LS	910,134	910,134
148					
149					
150	PREMIUM ASSOCIATED WITH PSD's				3,943,913

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: HALSEY AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	540	LF		
5	LENGTH OF THE PLATFORM EDGE [CANARSIE BOUND] =	540	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,080	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,080	LF	7	7,560
13	Remove 5' wide section of 3" deep structural slab to platform edge	5,400	SF	12	64,800
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	100	CY	2,500	250,000
16	Pair of dowels (front & rear) cast into existing at 12" O.C	2,164	EA	25	54,100
17	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
18	Polyethylene edge strip	1,080	LF	95	102,600
19	Provide sleeves for HV & LV wires	256	EA	110	28,160
20					
21	Platform edge finishes				
22	Demolition				
23	Remove existing tactile warning strip 2' wide	1,080	LF	15	16,200
24	Remove existing platform tiles	1,080	LF	12	12,960
25	Sawcut existing topping concrete at perimeter of removal area	1,080	LF	5	5,400
26	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,480	SF	8	51,840
27	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12' wide strip	480	SF	8	3,840
28	New Work				
29	New concrete topping to match existing	1,080	SF	15	16,200
30	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
31	Tactile Warning Strip - 2' wide strip along platform edge at door openings only (#32) & Platform end gates	384	LF	110	42,240
32	Misc. patchwork	1	LS	50,000	50,000
33					
34	Equipment Room [12'-0" x 16'-0"]				
35	Build off existing platform slab		Note		
36	Form 8" wide concrete curb including dowelling to platform slab	40	LF	90	3,600
37	CMU Wall for equipment room	400	SF	45	18,000
38	Vertical connections with existing structure	20	LF	25	500
39	Fire rated door including frame & hardware	1	EA	2,500	2,500
40	Exterior wall finish				
41	Ceramic Tiling to match existing	400	SF	40	16,000

STATION: HALSEY AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
42	Mosaic Band to match existing - Assuming 8" high	40	LF	120	4,800
43	Concrete cove to match existing	40	LF	20	800
44	Interior Wall Finish - Paint	400	SF	5	2,000
45	Allow for Misc. floor & ceiling finishes	192	SF	15	2,880
46	Allow for 4" thick concrete pads for equipment	48	SF	20	960
47	Allowance for Mechanical Scope	1	LS	40,000	40,000
48	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
49	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
50	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
52	**Automatic Platform Gates [APGs] - 4'-6" High**				
53	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
54	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	10,500	630,000
55	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
56	Platform End Gates (PEGs)	4	EA	13,000	52,000
57	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
58	Spare Parts - Approx. 10% of Material Cost	1	LS	202,170	202,170
59	Testing and commissioning	800	HRS	160	127,944
60	Product Warranty	1	LS	1,000,000	1,000,000
61	Allowance for Braille Signage	64	EA	2,500	160,000
62					
63	**Electrical**				
64	Electrical Upgrades				
65	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
66	Power and Lighting				
67	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
68	Allow for conduit / cable runs for power and communications under platform edge	1,080	LF	60	64,800
	PSD Connections	1	LS	75,000	75,000
70	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
71	Power to PSD Room from EDR including track crossing if needed	500	LF	60	30,000
72	Reserve power to PSD Room from EDR including track crossing if needed	500	LF	60	30,000
73	Reference Tier 2/3 Report [Page 1 of 9], No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
74	Grounding				
75	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
76	MISC				
77	Testing and commissioning	1	LS	30,000	30,000
78	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
79					
80	**Communications**				
81	FA System				
82	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
83	CCTV coverage				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: HALSEY AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
84	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
85	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
86	Berthing Technology Sensors				
87	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
88	Train Door Detection System				
89	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
90	Entrapment concerns				
91	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
92	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
93	Engineering and Testing	2,000	Hrs	160	319,860
94	Centralized monitoring/control				
95	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
96	MISC				
97	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
98	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
99	Site Survey and Inspections	1	LS	100,000	100,000
100	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
101	Furnish Test Equipment allowance	1	LS	500,000	500,000
102	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
103					
104	Out of hours Work				
105	No allowance included for work outside normal working hours		Note		EXCL.
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Allow loss of production to work at night say 50%	1	LS	3,414,593	3,414,593
112	TOTAL PSD WORK:				$ 14,796,569

114					
115	ADD ALTERNATIVE				
116					
117	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
118					
119	ADD				
120	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
121	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	15,000	900,000
122	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000

22-Jun-18

STATION: HALSEY AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
123	Platform End Gates (PEGs)	4	EA	18,000	72,000
124	Fixed Panels including framing and support; Assuming 8'-0" high	4,880	SF	750	3,660,282
125	Spare Parts - Approx. 10% of Material Cost	1	LS	377,537	377,537
126	Structual framing / bracing				
127	HSS4x4x1/2 hanger	4.1	TONS	17,500	71,858
128	L6x6x1/2 continuous angle	7.9	TONS	17,500	139,104
129	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
130	Platform Edge Repair				
131	Remove 3' wide section of 3" deep structural slab to platform edge	1,080	LF	27	29,160
132	Replace platform edge; Approx. 3'-0" wide x 6" minimum depth at cantilever edge	1,080	LF	109	117,720
133	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	1,128	EA	10	11,280
134					
135	OMIT				
136	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	-64	EA	15,000	(960,000)
137	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #22 per Platform	-60	EA	10,500	(630,000)
138	Double egress/service gate in the center of the platform; #1 per Platform	-2	EA	20,000	(40,000)
139	Platform End Gates (PEGs)	-4	EA	13,000	(52,000)
140	Fixed Panels including framing and support; 4'-6" High	-2,250	SF	750	(1,687,500)
141	Spare Parts - Approx. 10% of Material Cost	-1	LS	202,170	(202,170)
142	Platform Edge Reconstruction work	-1	LS	461,060	(461,060)
143	Remove allowance for cast in sleeves for LV & HV power	-256	EA	110	(28,160)
144	Conduit running under Platform Edge	-1,080	LF	30	(32,400)
145					
146	Allow loss of production to work at night say 50%	1	LS	910,134	910,134
147					
148	PREMIUM ASSOCIATED WITH PSD's				3,943,913

22-Jun-18

STATION: WILSON AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	540	LF		
5	LENGTH OF THE PLATFORM EDGE [CANARSIE BOUND] =	540	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,080	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,080	LF	7	7,560
13	Remove 5' wide section of 3" deep structural slab to platform edge	5,400	SF	12	64,800
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	100	CY	2,500	250,000
16	Pair of dowels (front & rear) cast into existing at 12" O.C	2,164	EA	25	54,100
17	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
18	Polyethylene edge strip	1,080	LF	95	102,600
19	Provide sleeves for HV & LV wires	256	EA	110	28,160
20					
21	Platform edge finishes				
22	Demolition				
23	Remove existing tactile warning strip 2' wide	1,080	LF	15	16,200
24	Remove existing platform tiles	1,080	LF	12	12,960
25	Sawcut existing topping concrete at perimeter of removal area	1,080	LF	5	5,400
26	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,480	SF	8	51,840
27	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12' wide strip	480	SF	8	3,840
28	New Work				
29	New concrete topping to match existing	1,080	SF	15	16,200
30	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
31	Tactile Warning Strip - 2' wide strip along platform edge at door openings only (#32) & Platform end gates	384	LF	110	42,240
32	Misc. patchwork	1	LS	50,000	50,000
33					
34	Equipment Room				
35	Manhattan Bound [7'-0" x 16'-6"]				
36	Build off existing platform slab		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	24	LF	90	2,115
38	CMU Wall for equipment room	235	SF	45	10,575
39	Vertical connections with existing structure	20	LF	25	500
40	Fire rated door including frame & hardware	1	EA	2,500	2,500
41	Exterior wall finish				

STATION: WILSON AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
42	Ceramic Tiling to match existing	235	SF	40	9,400
43	Mosaic Band to match existing - Assuming 8" high	24	LF	120	2,820
44	Concrete cove to match existing	24	LF	20	470
45	Interior Wall Finish - Paint	235	SF	5	1,175
46	Allow for Misc. floor & ceiling finishes	116	SF	15	1,733
47	Allow for 4" thick concrete pads for equipment	29	SF	20	578
48	Allowance for Mechanical Scope	1	LS	40,000	40,000
49	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
50	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
51	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
52	Canarsie Bound [7'-0" x 16'-6"]				
53	Build off existing platform slab		Note		
54	Form 8" wide concrete curb including dowelling to platform slab	24	LF	90	2,115
55	CMU Wall for equipment room	235	SF	45	10,575
56	Vertical connections with existing structure	20	LF	25	500
57	Fire rated door including frame & hardware	1	EA	2,500	2,500
58	Exterior wall finish				
59	Ceramic Tiling to match existing	235	SF	40	9,400
60	Mosaic Band to match existing - Assuming 8" high	24	LF	120	2,820
61	Concrete cove to match existing	24	LF	20	470
62	Interior Wall Finish - Paint	235	SF	5	1,175
63	Allow for Misc. floor & ceiling finishes	116	SF	15	1,733
64	Allow for 4" thick concrete pads for equipment	29	SF	20	578
65	Allowance for Mechanical Scope	1	LS	40,000	40,000
66	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
67	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
68	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
70	Automatic Platform Gates [APGs] - 4'-6" High				
71	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
72	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	10,500	630,000
73	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
74	Platform End Gates (PEGs)	4	EA	13,000	52,000
75	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
76	Spare Parts - Approx. 10% of Material Cost	1	LS	202,170	202,170
77	Testing and commissioning	800	HRS	160	127,944
78	Product Warranty	1	LS	1,000,000	1,000,000
79	Allowance for Braille Signage	64	EA	2,500	160,000
80					
81	Electrical				
82	Electrical Upgrades				
83	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
84	Power and Lighting				
85	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

STATION: WILSON AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
86	Allow for conduit / cable runs for power and communications under platform edge	1,080	LF	60	64,800
	PSD Connections	1	LS	75,000	75,000
88	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
89	Power to PSD Room from EDR including track crossing if needed	1,100	LF	60	66,000
90	Reserve power to PSD Room from EDR including track crossing if needed	1,150	LF	60	69,000
91	Reference Tier 2/3 Report [Page 1 of 9], No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
92	Grounding				
93	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
94	MISC				
95	Testing and commissioning	1	LS	30,000	30,000
96	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
97					
98	Communications				
99	FA System				
100	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
101	CCTV coverage				
102	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
103	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
104	Berthing Technology Sensors				
105	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
106	Train Door Detection System				
107	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
108	Entrapment concerns				
109	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
110	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
111	Engineering and Testing	2,000	Hrs	160	319,860
112	Centralized monitoring/control				
113	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
114	MISC				
115	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
116	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
117	Site Survey and Inspections	1	LS	100,000	100,000
118	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
119	Furnish Test Equipment allowance	1	LS	500,000	500,000
120	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
121					

22-Jun-18

STATION: WILSON AVENUE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
122	Out of hours Work				
123	No allowance included for work outside normal working hours		Note		EXCL.
124					
125	Training				
126	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
127					
128	Allow loss of production to work at night say 50%	1	LS	3,505,100	3,505,100
130	TOTAL PSD WORK:				$ 15,188,766

132					
133	ADD ALTERNATIVE				
134					
135	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
136					
137	ADD				
138	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
139	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	15,000	900,000
140	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
141	Platform End Gates (PEGs)	4	EA	18,000	72,000
142	Fixed Panels including framing and support; Assuming 8'-0" high	4,880	SF	750	3,660,282
143	Spare Parts - Approx. 10% of Material Cost	1	LS	377,537	377,537
144	Structual framing / bracing				
145	HSS4x4x1/2 hanger	4.1	TONS	17,500	71,858
146	L6x6x1/2 continuous angle	7.9	TONS	17,500	139,104
147	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
	Platform Edge Repair				
149	Remove 3' wide section of 3" deep structural slab to platform edge				N/A
150	Replace platform edge; Approx. 3'-0" wide x 6" minimum depth at cantilever edge				N/A
151	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				N/A
152					
153	OMIT				
154	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	-64	EA	15,000	(960,000)
155	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #22 per Platform	-60	EA	10,500	(630,000)
156	Double egress/service gate in the center of the platform; #1 per Platform	-2	EA	20,000	(40,000)
157	Platform End Gates (PEGs)	-4	EA	13,000	(52,000)
158	Fixed Panels including framing and support; 4'-6" High	-2,250	SF	750	(1,687,500)
159	Spare Parts - Approx. 10% of Material Cost	-1	LS	202,170	(202,170)
160	Platform Edge Reconstruction work	-1	LS	461,060	(461,060)
161	Remove allowance for cast in sleeves for LV & HV power	-256	EA	110	(28,160)
162	Conduit running under Platform Edge	-1,080	LF	30	(32,400)
163					
164	Allow loss of production to work at night say 50%	1	LS	862,686	862,686
165					
166	PREMIUM ASSOCIATED WITH PSD's				3,738,305

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: BUSHWICK AVE - ABERDEEN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	540	LF		
5	LENGTH OF THE PLATFORM EDGE [CANARSIE BOUND] =	540	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,080	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,080	LF	7	7,560
13	Remove 5' wide section of 3" deep structural slab to platform edge	5,400	SF	12	64,800
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	100	CY	2,500	250,000
16	Pair of dowels (front & rear) cast into existing at 12" O.C	2,164	EA	25	54,100
17	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
18	Polyethylene edge strip	1,080	LF	95	102,600
19	Provide sleeves for HV & LV wires	256	EA	110	28,160
20					
21	Platform edge finishes				
22	Demolition				
23	Remove existing tactile warning strip 2' wide	1,080	LF	15	16,200
24	Remove existing platform tiles	1,080	LF	12	12,960
25	Sawcut existing topping concrete at perimeter of removal area	1,080	LF	5	5,400
26	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,480	SF	8	51,840
27	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12' wide strip	480	SF	8	3,840
28	New Work				
29	New concrete topping to match existing	1,080	SF	15	16,200
30	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
31	Tactile Warning Strip - 2' wide strip along platform edge at door openings only (#32) & Platform end gates	384	LF	110	42,240
32	Misc. patchwork	1	LS	50,000	50,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: BUSHWICK AVE - ABERDEEN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
33					
34	Equipment Room				
35	Manhattan Bound [7'-0" x 17'-0"]				
36	Build off existing platform slab		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	31	LF	90	2,790
38	CMU Wall for equipment room	310	SF	45	13,950
39	Vertical connections with existing structure	20	LF	25	500
40	Fire rated door including frame & hardware	1	EA	2,500	2,500
41	Exterior wall finish				
42	Ceramic Tiling to match existing	310	SF	40	12,400
43	Mosaic Band to match existing - Assuming 8" high	31	LF	120	3,720
44	Concrete cove to match existing	31	LF	20	620
45	Interior Wall Finish - Paint	310	SF	5	1,550
46	Allow for Misc. floor & ceiling finishes	119	SF	15	1,785
47	Allow for 4" thick concrete pads for equipment	30	SF	20	595
48	Allowance for Mechanical Scope	1	LS	40,000	40,000
49	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
50	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
51	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
52	Canarsie Bound [7'-0" x 17'-0"]				
53	Build off existing platform slab		Note		
54	Form 8" wide concrete curb including dowelling to platform slab	31	LF	90	2,790
55	CMU Wall for equipment room	310	SF	45	13,950
56	Vertical connections with existing structure	20	LF	25	500
57	Fire rated door including frame & hardware	1	EA	2,500	2,500
58	Exterior wall finish				
59	Ceramic Tiling to match existing	310	SF	40	12,400
60	Mosaic Band to match existing - Assuming 8" high	31	LF	120	3,720
61	Concrete cove to match existing	31	LF	20	620
62	Interior Wall Finish - Paint	310	SF	5	1,550
63	Allow for Misc. floor & ceiling finishes	119	SF	15	1,785
64	Allow for 4" thick concrete pads for equipment	30	SF	20	595
65	Allowance for Mechanical Scope	1	LS	40,000	40,000
66	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
67	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
68	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
70	Automatic Platform Gates [APGs] - 4'-6" High				
71	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: BUSHWICK AVE - ABERDEEN STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
72	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	10,500	630,000
73	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
74	Platform End Gates (PEGs)	4	EA	13,000	52,000
75	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
76	Spare Parts - Approx. 10% of Material Cost	1	LS	202,170	202,170
77	Testing and commissioning	800	HRS	160	127,944
78	Product Warranty	1	LS	1,000,000	1,000,000
79	Allowance for Braille Signage	64	EA	2,500	160,000
80					
81	Electrical				
82	Electrical Upgrades				
83	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
84	Power and Lighting				
85	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
86	Allow for conduit / cable runs for power and communications under platform edge	1,080	LF	60	64,800
	PSD Connections	1	LS	75,000	75,000
88	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
89	Power to PSD Room from EDR including track crossing if needed	900	LF	60	54,000
90	Reserve power to PSD Room from EDR including track crossing if needed	950	LF	60	57,000
91	Reference Tier 2/3 Report [Page 1 of 9], No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
92	Grounding				
93	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
94	MISC				
95	Testing and commissioning	1	LS	30,000	30,000
96	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
97					
98	Communications				
99	FA System				
100	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
101	CCTV coverage				
102	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
103	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
104	Berthing Technology Sensors				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: BUSHWICK AVE - ABERDEEN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
105	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
106	Train Door Detection System				
107	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
108	Entrapment concerns				
109	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
110	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
111	Engineering and Testing	2,000	Hrs	160	319,860
112	Centralized monitoring/control				
113	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
114	MISC				
115	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
116	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
117	Site Survey and Inspections	1	LS	100,000	100,000
118	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
119	Furnish Test Equipment allowance	1	LS	500,000	500,000
120	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
121					
122	Out of hours Work				
123	No allowance included for work outside normal working hours		Note		EXCL.
124					
125	Training				
126	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
127					
128	Allow loss of production to work at night say 50%	1	LS	3,503,027	3,503,027
130	TOTAL PSD WORK:				$ 15,179,783

132					
133	ADD ALTERNATIVE				
134					
135	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
136					
137	ADD				

22-Jun-18

STATION: BUSHWICK AVE - ABERDEEN STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
138	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000
139	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	15,000	900,000
140	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
141	Platform End Gates (PEGs)	4	EA	18,000	72,000
142	Fixed Panels including framing and support; Assuming 8'-0" high	4,880	SF	750	3,660,282
143	Spare Parts - Approx. 10% of Material Cost	1	LS	377,537	377,537
144	Structual framing / bracing				
145	HSS4x4x1/2 hanger	4.1	TONS	17,500	71,858
146	L6x6x1/2 continuous angle	7.9	TONS	17,500	139,104
147	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
	Platform Edge Repair				-
149	Remove 3' wide section of 3" deep structural slab to platform edge	1,080	LF	27	29,160
150	Replace platform edge; Approx. 3'-0" wide x 6" minimum depth at cantilever edge	1,080	LF	109	117,720
151	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	1,128	EA	10	11,280
152					
153	OMIT				
154	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	-64	EA	15,000	(960,000)
155	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #22 per Platform	-60	EA	10,500	(630,000)
156	Double egress/service gate in the center of the platform; #1 per Platform	-2	EA	20,000	(40,000)
157	Platform End Gates (PEGs)	-4	EA	13,000	(52,000)
158	Fixed Panels including framing and support; 4'-6" High	-2,250	SF	750	(1,687,500)
159	Spare Parts - Approx. 10% of Material Cost	-1	LS	202,170	(202,170)
160	Platform Edge Reconstruction work	-1	LS	461,060	(461,060)
161	Remove allowance for cast in sleeves for LV & HV power	-256	EA	110	(28,160)
162	Conduit running under Platform Edge	-1,080	LF	30	(32,400)
163					
164	Allow loss of production to work at night say 50%	1	LS	910,134	910,134
165					
166	PREMIUM ASSOCIATED WITH PSD's				3,943,913

22-Jun-18

STATION: BROADWAY JUNCTION

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	540	LF		
5	LENGTH OF THE PLATFORM EDGE [CANARSIE BOUND] =	540	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	1,080	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	1,080	LF	7	7,560
13	Remove 5' wide section of 3" deep structural slab to platform edge	5,400	SF	12	64,800
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	100	CY	2,500	250,000
16	Pair of dowels (front & rear) cast into existing at 12" O.C	2,164	EA	25	54,100
17	Cast in assemblies for PSD holding down bolts	512	EA	180	92,160
18	Polyethylene edge strip	1,080	LF	95	102,600
19	Provide sleeves for HV & LV wires	256	EA	110	28,160
20					
21	Platform edge finishes				
22	Demolition				
23	Remove existing tactile warning strip 2' wide	1,080	LF	15	16,200
24	Remove existing platform tiles	1,080	LF	12	12,960
25	Sawcut existing topping concrete at perimeter of removal area	1,080	LF	5	5,400
26	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	6,480	SF	8	51,840
27	Remove existing 3" concrete topping at 40' long ADA boarding area; Assume balance of Manhattan bound platform width i.e. 20' wide strip at ADA boarding area	560	SF	8	4,480
28	Remove existing 3" concrete topping at 40' long ADA boarding area; Assume balance of Canarsie bound platform width i.e. 19' wide strip at ADA boarding area	520	SF	8	4,160
29	New Work				
30	New concrete topping to match existing	1,080	SF	15	16,200
31	New concrete topping at ADA boarding area to match existing	560	SF	15	8,400
32	Tactile Warning Strip - 2' wide strip along platform edge at door openings only (#32) & Platform end gates	384	LF	110	42,240
33	Misc. patchwork	1	LS	50,000	50,000
34					
35	Equipment Room [12'-0" x 16'-0"]				
36	Build off existing platform slab		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	40	LF	90	3,600
38	CMU Wall for equipment room	400	SF	45	18,000

STATION: BROADWAY JUNCTION

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
39	Vertical connections with existing structure	20	LF	25	500
40	Fire rated door including frame & hardware	1	EA	2,500	2,500
41	Exterior wall finish				
42	Ceramic Tiling to match existing	400	SF	40	16,000
43	Mosaic Band to match existing - Assuming 8" high	40	LF	120	4,800
44	Concrete cove to match existing	40	LF	20	800
45	Interior Wall Finish - Paint	400	SF	5	2,000
46	Allow for Misc. floor & ceiling finishes	192	SF	15	2,880
47	Allow for 4" thick concrete pads for equipment	48	SF	20	960
48	Allowance for Mechanical Scope	1	LS	40,000	40,000
49	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
50	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
51	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
53	**Automatic Platform Gates [APGs] - 4'-6" High**				
54	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	64	EA	15,000	960,000
55	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	10,500	630,000
56	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
57	Platform End Gates (PEGs)	4	EA	13,000	52,000
58	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
59	Spare Parts - Approx. 10% of Material Cost	1	LS	202,170	202,170
60	Testing and commissioning	800	HRS	160	127,944
61	Product Warranty	1	LS	1,000,000	1,000,000
62	Allowance for Braille Signage	64	EA	2,500	160,000
63					
64	**Electrical**				
65	Electrical Upgrades				
66	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
67	Power and Lighting				
68	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
69	Allow for conduit / cable runs for power and communications under platform edge	1,080	LF	60	64,800
	PSD Connections	1	LS	75,000	75,000
71	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
72	Power to PSD Room from EDR including track crossing if needed	400	LF	60	24,000
73	Reserve power to PSD Room from EDR including track crossing if needed	400	LF	60	24,000
74	Reference Tier 2/3 Report [Page 1 of 9], No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
75	Grounding				
76	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
77	MISC				
78	Testing and commissioning	1	LS	30,000	30,000
79	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
80					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'L' (Canarsie) Line Stations in Brooklyn

22-Jun-18

STATION: BROADWAY JUNCTION

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
81	Communications				
82	FA System				
83	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
84	CCTV coverage				
85	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	80	EA	12,000	960,000
86	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
87	Berthing Technology Sensors				
88	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	16,000	128,000
89	Train Door Detection System				
90	Train Door Detection Sensor including software and hardware requirements	8	EA	15,000	120,000
91	Entrapment concerns				
92	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	192	EA	4,629	888,814
93	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	192	EA	5,566	1,068,588
94	Engineering and Testing	2,000	Hrs	160	319,860
95	Centralized monitoring/control				
96	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
97	MISC				
98	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
99	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
100	Site Survey and Inspections	1	LS	100,000	100,000
101	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
102	Furnish Test Equipment allowance	1	LS	500,000	500,000
103	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
104					
105	Out of hours Work				
106	No allowance included for work outside normal working hours		Note		EXCL.
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Allow loss of production to work at night say 50%	1	LS	3,412,793	3,412,793
113	TOTAL PSD WORK:				$ 14,788,769

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (8 Cars x 4 Doors = 32 No. per platform)	64	EA	25,000	1,600,000

22-Jun-18

STATION: BROADWAY JUNCTION

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
122	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #30 per Platform	60	EA	15,000	900,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,880	SF	750	3,660,282
126	Spare Parts - Approx. 10% of Material Cost	1	LS	377,537	377,537
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	4.1	TONS	17,500	71,858
129	L6x6x1/2 continuous angle	7.9	TONS	17,500	139,104
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
	Platform Edge Repair				
132	Remove 3' wide section of 3" deep structural slab to platform edge				N/A
133	Replace platform edge; Approx. 3'-0" wide x 6" minimum depth at cantilever edge				N/A
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				N/A
135					
136	OMIT				
137	Automatic bi-parting gates; Assumed 6'-0" wide (8 Cars x 4 Doors = 32 No. per platform)	-64	EA	15,000	(960,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #22 per Platform	-60	EA	10,500	(630,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	-2	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	-4	EA	13,000	(52,000)
141	Fixed Panels including framing and support; 4'-6" High	-2,250	SF	750	(1,687,500)
142	Spare Parts - Approx. 10% of Material Cost	-1	LS	202,170	(202,170)
143	Platform Edge Reconstruction work	-1	LS	461,060	(461,060)
144	Remove allowance for cast in sleeves for LV & HV power	-256	EA	110	(28,160)
145	Conduit running under Platform Edge	-1,080	LF	30	(32,400)
146					
147	Allow loss of production to work at night say 50%	1	LS	862,686	862,686
148					
149	PREMIUM ASSOCIATED WITH PSD's				3,738,305

Appendix F – Maintenance Cost Estimate

MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the	9	$ 63,500 per month [Year 01]	$ 571,500		
	platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance	12	$ 83,590 per month [Year 02]	$ 1,003,080		
	since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
	remedial repair performed as needed, 24/7, for the	12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
	platform screen door system and ancillary equipment.					
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663		

ITEM NO.	DESCRIPTION		RATE	
7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *	
		Year 3	$ 257 per hour *	
	Optional :	Year 4	$ 268 per hour *	
	Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

MTA New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR 'N' LINE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

FINAL SUBMITTAL DATE: January 31, 2019

STV 100 Years

Table of Contents

Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. Our Tier 1 analysis found no instances of door misalignment between car classes for this line. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 46 evaluated stations, 36 have been found to be not suitable for the installation of PSDs.

[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to low-height barriers]

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues; the platform edge barriers are 15" wide. Where an existing object (wall, stair, and railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Stations are found to be infeasible where these PSDs:
  - Limit the ability of a wheelchair to turn a 5'-0" circle
  - Limit path of travel to less than a 32" pinch width (defined as an obstruction that measures less than 2'-0" longitudinally, i.e. columns)
  - Limit path of travel to be less than a 36" corridor as defined by the edge of a staircase, railing or room
- Insufficient space for the PSD equipment room; the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow; due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements in regard to the placement of these new barriers in an existing station environment.
- Structural considerations; existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the previously proposed 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the PSD barriers and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is used for refuse removal at the N line stations. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the (off) loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in damage from these carts along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 22% of the 'N' Line stations. Total implementation cost would be $318.9M for APGs and $363.5M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; That estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of $931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 10 feasible stations, the aggregate annual maintenance cost would be $9.3M.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'N' Line Stations

Summary Table

N Service Summary of Feasibility					(22% Feasible 10 / 46)		
MRN No.	**Station Names**	**Station Type**	**Platform Type**	**Feasibility**	**Issues/Reason for Failure**	**Cost APGs**	**Cost PSDs**
1	Astoria - Ditmars Blvd.	SUB	Center/Island	No	Precast Platform		
2	Astoria Blvd	SUB	Side	No	Precast Platform		
3	30th Ave. Grand Ave	SUB	Side	No	Precast Platform		
4	Broadway	SUB	Side	No	Precast Platform		
5	36th Avenue Washington Avenue	SUB	Center/Island	No	Precast Platform		
6	39th Avenue Beebe Ave	ELV	Center/Island	No	Precast Platform		
7	Lexington Ave. 59th St.	ELV	Side	No	ADA Clearance		
8	5th Ave. / 59th St.	ELV	Side	Yes	-	$31.2M	$40.0M
9	57th Street 7th Ave	ELV	Side	No	ADA Clearance		
10	49th Street	ELV	Side	Yes	-	$33.5M	$43.5M
11	Times Square 42nd Street	SUB	Center/Island	No	ADA Clearance		
12	34th Street Herald Sq.	EMB	Center/Island	No	ADA Clearance		
13	28th Street	ELV	Center/Island	No	ADA Clearance		
14	23rd Street	ELV	Center/Island	No	ADA Clearance		
15	14th St. Union Square	ELV	Center/Island	No	ADA Clearance		
16	8th St. NYU	ELV	Center/Island	No	ADA Clearance		
17	Prince Street	ELV	Side	No	ADA Clearance		
18	Canal Street (UL)	ELV	Side	No	ADA Clearance		
19	Canal Street (LL)	SUB	Side	No	No Room Location		
20	City Hall	SUB	Center/Island	No	ADA Clearance		
21	Cortlandt Street	SUB	Center/Island	No	ADA Clearance		
22	Rector Street	SUB	Center/Island	No	ADA Clearance		
23	Whitehall St. South Ferry	SUB	Center/Island	No	ADA Clearance		
24	Court Street Montague St.	SUB	Side	No	No Room Location		
25	Jay St. Metrotech	SUB	Center/Island	No	ADA Clearance		
26	Dekalb Avenue Flatbush Ave	SUB	Center/Island	Yes	-	$32.2M	$41.4M
27	Atlantic Ave. Barclays Ctr.	SUB	Side	Yes	-	$31.4M	$39.9M
28	Union St.	SUB	Side	No	No Room Location		
29	9th Street 4th Ave	SUB	Side	No	No Room Location		
30	Prospect Avenue	SUB	Side	No	No Room Location		
31	25th Street	SUB	Side	No	No Room Location		
32	36th Street	SUB	Center/Island	No	No Room Location		
33	45th Street	SUB	Side	No	ADA Clearance		
34	53rd Street	SUB	Side	No	ADA Clearance		
35	59th Street	SUB	Side	No	ADA Clearance		
58	Coney Island Stillwell	SUB	Side	Yes	-	$31.0M	$40.0M
71	8th Avenue	SUB	Side	Yes	-	$31.3M	$39.0M
72	Fort Hamilton Parkway	SUB	Center/Island	Yes	-	$31.7M	$40.0M

MRN No.	Station Names	Station Type	Platform Type	Feasibility	Issues/Reason for Failure	Cost APGs	Cost PSDs
73	New Utrecht Avenue	SUB	Side	No	ADA Clearance		
74	18th Avenue 63rd St.	SUB	Center/Island	No	ADA Clearance		
75	20th Avenue	SUB	Side	No	ADA Clearance		
76	Bay Pkwy/22nd Avenue	ELV	Center/Island	Yes	-	$32.6M	$41.4M
77	Kings Highway	ELV	Center/Island	No	No Room Location		
78	Avenue U	ELV	Side	Yes	-	$31.0M	$38.5M
73	New Utrecht Avenue	SUB	Side	No	ADA Clearance		
74	18th Avenue 63rd St.	SUB	Center/Island	No	ADA Clearance		
79	86th Street	ELV	Side	No	ADA Clearance		
461	Queensboro Plaza	ELV	Center/Island	Yes	-	$33.1M	-
					Total	**$318.9M**	**$363.5M**

1.0 Station Assessments

1.01 – MR 001 | Astoria Ditmars Boulevard Station

Summary: *Astoria Ditmars Boulevard Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

Astoria Ditmars Boulevard Station is an elevated station consisting of a center / island platform. The platform structure is precast concrete. The width of the platform is 15'-0" throughout. There are two staircases at the center of the platform. The platform is straight with two rows of a columns supporting the station canopy. Column faces measure 3'-0" from the platform edge throughout. The canopy covers the center third of the platform. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Astoria Ditmars Boulevard Station

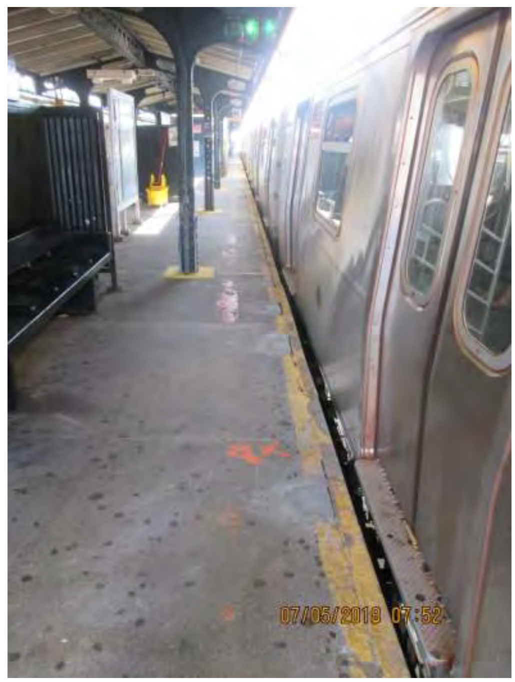

Figure 2 *– Precast Slab Seams*
Astoria Ditmars Boulevard Station

1.02 – MR 002 | Astoria Boulevard Station

__Summary:__ Astoria Boulevard Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).

Description

Astoria Boulevard Station is an elevated station with two center / island platforms. The platform structures are precast concrete. The width of the platforms is 17'-8" throughout. There are two staircases at the center of the platforms. The platforms are straight with two rows of a columns supporting their respective station canopies. Column faces measure 3'-4" from their adjacent platform edges throughout. The canopies cover approximately half of the platforms. See figure 1 & 2 for reference.

***Figure 1** – General Station Condition*
Astoria Boulevard Station

***Figure 2** – Precast Slab*
Astoria Boulevard Station

1.03 – MR 003 | 30th Avenue Station

Summary: *30th Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

30th Avenue Station is an elevated station with two straight side platforms. The platform structures are precast concrete. The width of the platforms is approximately 11'-0", narrowing to 8'-2" at the south ends. There are two staircases at the center of each platform. The platforms are straight with a single row of columns supporting their respective station canopies. Column faces measure 3'-0" from their adjacent platform edges throughout. The canopies cover approximately half of the platforms. See figure 1 & 2 for reference.

Figure 1 *– Overall view*
30th Avenue Station

Figure 2 *– Precast concrete platforms*
30th Avenue Station

1.04 – MR 004 | Broadway Station

Summary: *Broadway Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

Broadway Station is an elevated station with two straight side platforms. The platform structures are precast concrete. There are two staircases at the center of each platform. The platforms are straight with a single row of columns supporting their respective station canopies the canopies cover approximately half of the platforms.

NOTE: Station specific dimensions and photographs could not be obtained at the time of this report due to station closure for rehabilitation.

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1.05 – MR 005 | 36th Avenue Station

***Summary:** 36th Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

36th Avenue Station is an elevated station with two straight side platforms. The platform structures are precast concrete. The width of the platforms is approximately 11'-0. There are two staircases at the center of each platform. The platforms are straight with a single row of columns supporting their respective station canopies. Column faces measure 4'-0" from their adjacent platform edges throughout. The canopies cover approximately half of the platforms. See figure 1 & 2 for reference.

***Figure 1** – Overall view*
36th Avenue Station

***Figure 2** – Precast concrete platforms*
36th Avenue Station

n

1.06 – MR 006 | 39th Avenue Station

Summary: *39th Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

39th Avenue Station is an elevated station with two straight side platforms. The platform structures are precast concrete. There are two staircases at the center of each platform. The platforms are straight with a single row of columns supporting their respective station canopies the canopies cover approximately half of the platforms.

NOTE: Station specific dimensions and photographs could not be obtained at the time of this report due to station closure for rehabilitation.

1.07 – MR 007 | Lexington Avenue / 59th Street Station

Summary: *Lexington Avenue / 59th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at all obstructions as the remaining width would be 30" (see figure 1).*

Description

Lexington Avenue / 59th Street Station is a below-grade station with one straight center / island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 20'-0" throughout. Columns are spaced 15' on center with column faces 4'-0" away from the platform edges. The walls at the end of platform are 45" from the platform edge. The implementation of a platform edge barrier would reduce this width to 30" or less* which would not allow for ADA compliant wheelchair movement. Please see **figure 1** for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

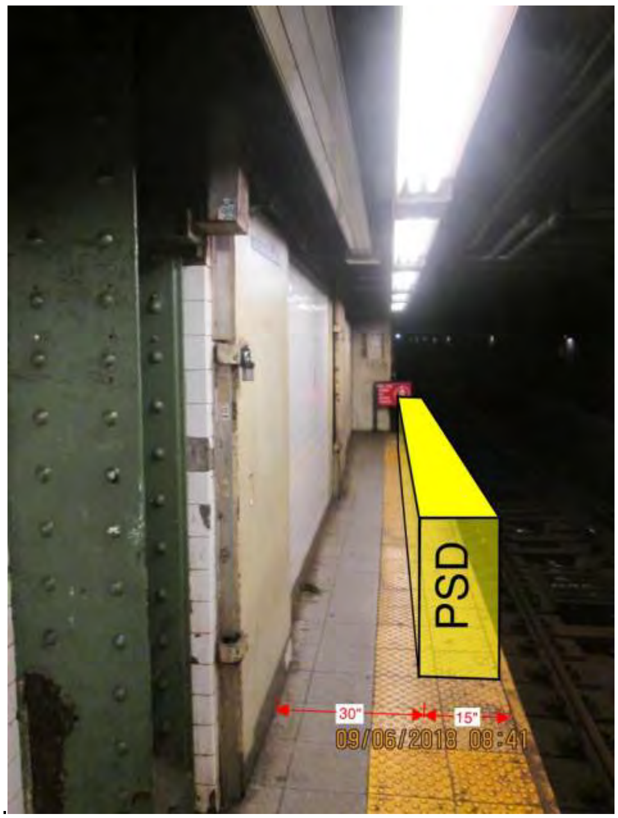

***Figure 1** – Non-Compliant ADA condition*
Lexington 59th Street Station

1.08 – MR 008 | Fifth Avenue / 59th Street Station

Summary: *Fifth Avenue / 59th Street Station is feasible for both APGs and PSDs. There is one ceiling mounted signal located at the center of each platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power capacity could not be ascertained due to inaccessibility during survey. However, a lack of adequate existing power is not considered to be a determining factor of future feasibility.*

Description

Fifth Avenue / 59th Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 3'-6" from the platform edge. The southbound platform width is approximately 11'-10" throughout. The northbound platform width is approximately 11'-6" throughout. At the center of each platform there is one ceiling mounted signal located above the platform edge, with a vertical clearance of at least 7'-6". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Ceiling mounted signals located above the platform edge would need to be relocated in the implementation of full height PSDs. **(see Figure 3)**

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting

Equipment Room

The equipment room could be located at the west mezzanine flush to the wall (see **Figure 1, Figure 2**). The proposed room dimension is 27'-0" x 6-6".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed in 1995. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, reconstruction of the concrete platform edge will be required only for the installation of an APG system.

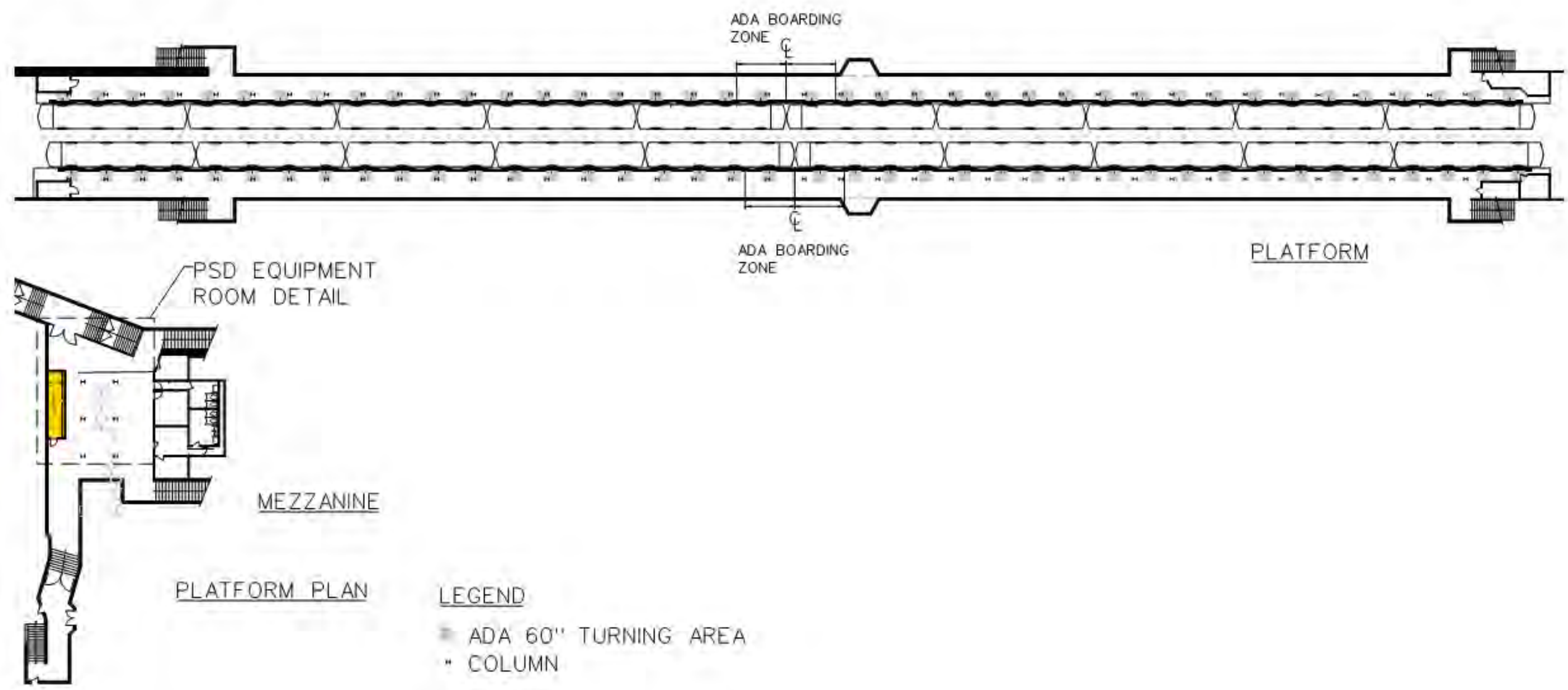

***Figure 1** – Overall Station Plan*
Fifth Avenue Station

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'N' Line Stations
(Fifth Avenue / 59th Street Station)

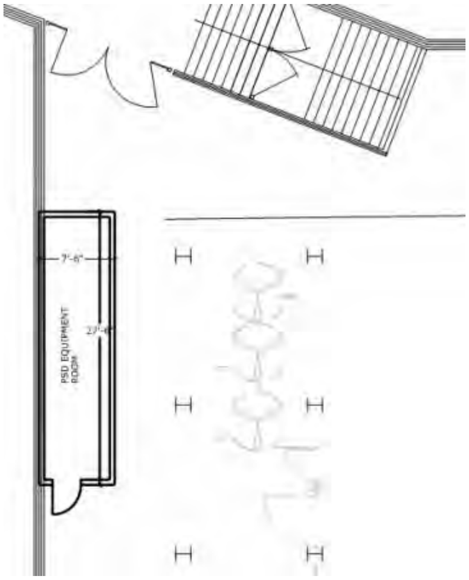

Figure 2 *– PSD Equipment Room Detail*
Fifth Avenue Station

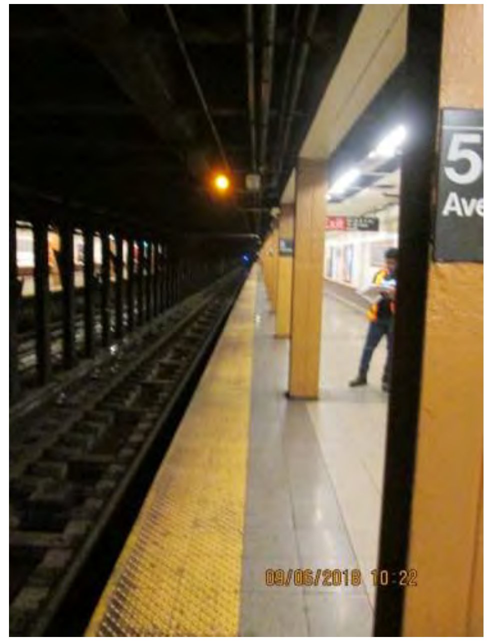

Figure 3 *– Signal above platform edge*
Fifth Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

An analysis of adequate electrical power at this station could not be performed due to inaccessibility during survey. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions is listed in the attached ROM estimate. The total cost for this station is estimated to be $31.2M to install APGs and $40.0M to install PSDs (See Appendix E)

***Figure 4** – Typical Platform View*
Fifth Avenue Station

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1.09 – MR 009 | 57th Street 7th Avenue Station

Summary: *57th Street 7th Avenue is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at the center stairs as the remaining width would be 27" (see figure 1).*

Description

The 57th Street Station is an underground station consisting of two center / island platforms. The platforms are approximately 19'-8" wide. The platforms are straight with two rows of columns at 42" from the edge of the platform. At four staircases columns flank the stair. The implementation of a platform edge barrier would reduce this width to 27" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-compliant ADA dimension*
57th Street Station

1.10 – MR 010 | 49th Street Station

Summary: *49th Street Station is feasible for both APGs and PSDs. There are two ceiling mounted signals located at the center of the southbound platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). The existing power supply is adequate.*

Description

The 49th Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns on the platforms. The platform width varies from approximately 7'-0" to 14'-8". On the southbound platform there are two ceiling mounted signals located above the platform edge, with a vertical clearance of at least 7'-6". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting

Equipment Room

The equipment room could be located as a split room, with one at the south control area of the southbound, and one located at the north control area of the southbound. (see **Figure 1, Figure 2**). The proposed room dimension is 16'-0" x 7'-6".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed in 1995. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, reconstruction of the concrete platform edge will be required only for the installation of an APG system.

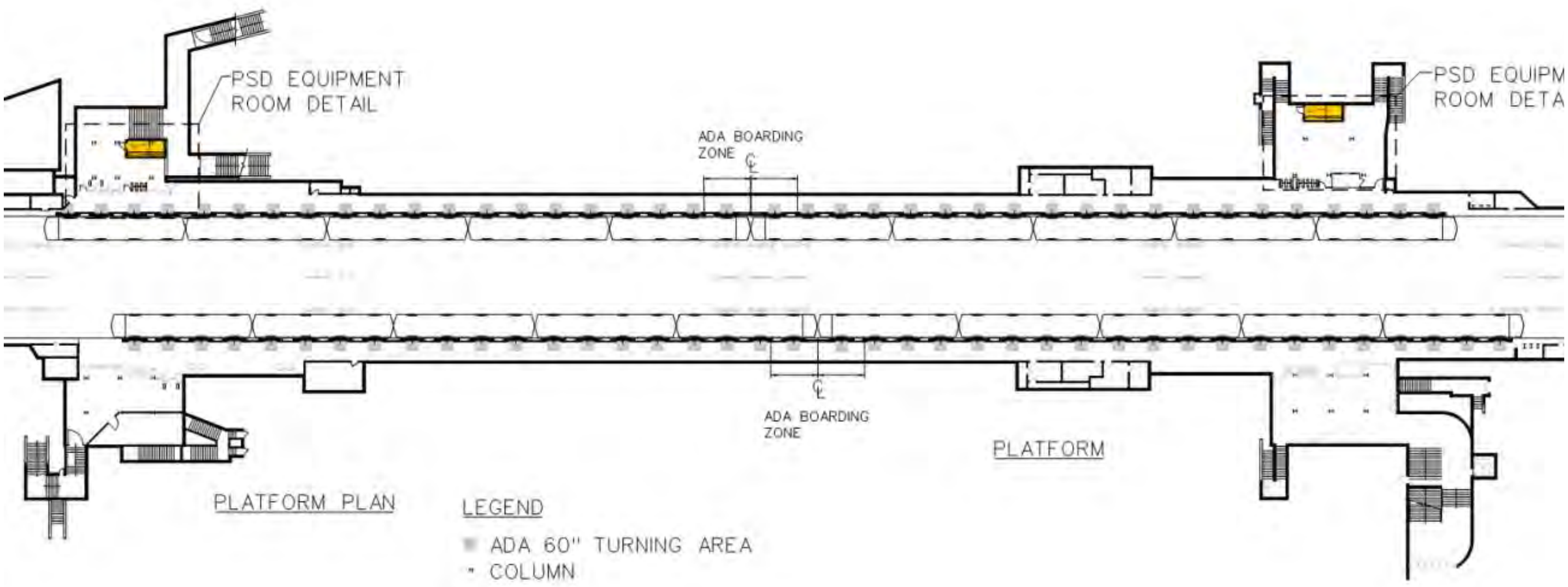

***Figure 1** – Overall plan*
49th Street Station

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'N' Line Stations
(49th Street Station)

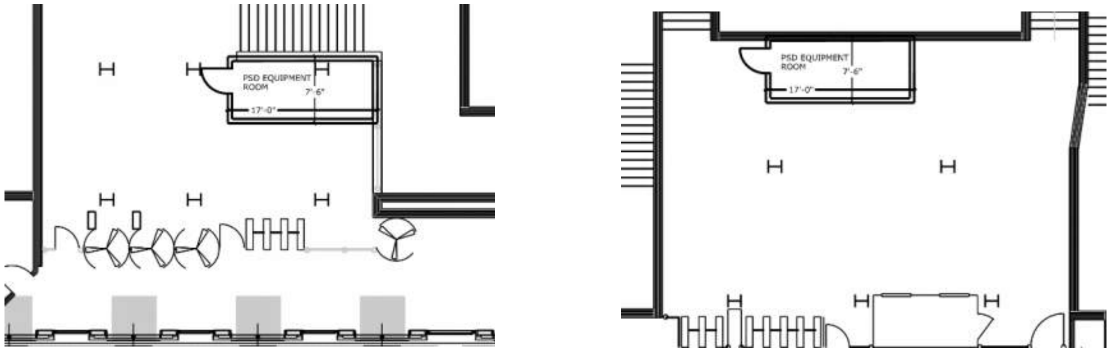

***Figure 2** – PSD Equipment Room Detail*
49th Street Station

Platform obstructions within 5' of edge:

None

Lighting:

Existing lighting: Throughout both platforms there are linear fluorescent fixtures mounted perpendicular to the platform edge in the ceiling coffers. No lighting reconfiguration will be required as part of a PSD installation.

***Figure 3** – General platform view*
49th Street Station

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 & 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	49th Street
Peak Demand Load from ConEd Report, Last **12** Months, (kW)	45.2
Apparent Power (kVA)	56.5
Station Peak Demand Load, Max Current, (A)	156.9
Maximum Number of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	352
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	449
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1-line diagram, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. This analysis is for **Normal service**. Meter reading is for 12 months.

Table 1. Power Capacity Analysis (Normal Service)

Station
Power Capacity Analysis

Station Name	49th Street
Peak Demand Load from ConEd Report, Last **12** Months, (kW)	27.2
Apparent Power (kVA)	34.0
Station Peak Demand Load, Max Current, (A)	94.5
Maximum Number of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	289
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	511
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1-line diagram, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. This analysis is for **Reserve service**. Meter reading is for 12 months.

Table 2. Power Capacity Analysis (Reserve)

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions is listed in the attached ROM estimate. The total cost for this station is estimated to be $33.5M to install APGs and $43.5M to install PSDs (See Appendix E)

1.11 – MR 011 | Times Square / 42nd Street Station

Summary: *Times Square / 42nd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 19" (see figure 1). (Note: this report covers only the Broadway BMT platforms; see reports for the Shuttle, 7, 1,2,3-line for the remainder of the station)*

Description

Times Square / 42nd Street Station is a below-grade station consisting of two center / island platforms. The platform width is 19-4" throughout. The platforms are straight with two rows of columns at 3'-8" from edge of platform. At the south end of the platforms, the columns flanking an equipment room are 2'-10" from the platform edge. The implementation of a platform edge barrier would reduce this width to 19"or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains

Figure 1 *–platform*
42nd Street / Times Square Station

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1.12 – MR 012 | 34th Street / Herald Square Station

Summary: *34th Street / Herald Square Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1). (Note: this report covers only the Broadway BMT platforms; see the B, D, F, M-line report for the remainder of the station)*

Description

34th Street / Herald Square Station is a below-grade station consisting of two center / island platforms. The platform width is 19-8" throughout. The platforms are straight with two rows of columns at 3'-4" from edge of platform. On the center / island platform the columns flank multiple staircases. The implementation of a platform edge barrier would reduce this width to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains

Figure 1 *–platform*
34th Street Station

1.13 – MR 013 | 28th Street Station

Summary: *28th Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

28th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns 3'-6" from the platform edge at each platform, though approximately one third of the platform is column-free. The platform width varies from 6'-0" to 9'-5. Due to the extremely limited width of the existing platforms and control areas, there is no available space for the equipment room. Figure 2, below, shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the southbound control area. The northbound control area is similar..

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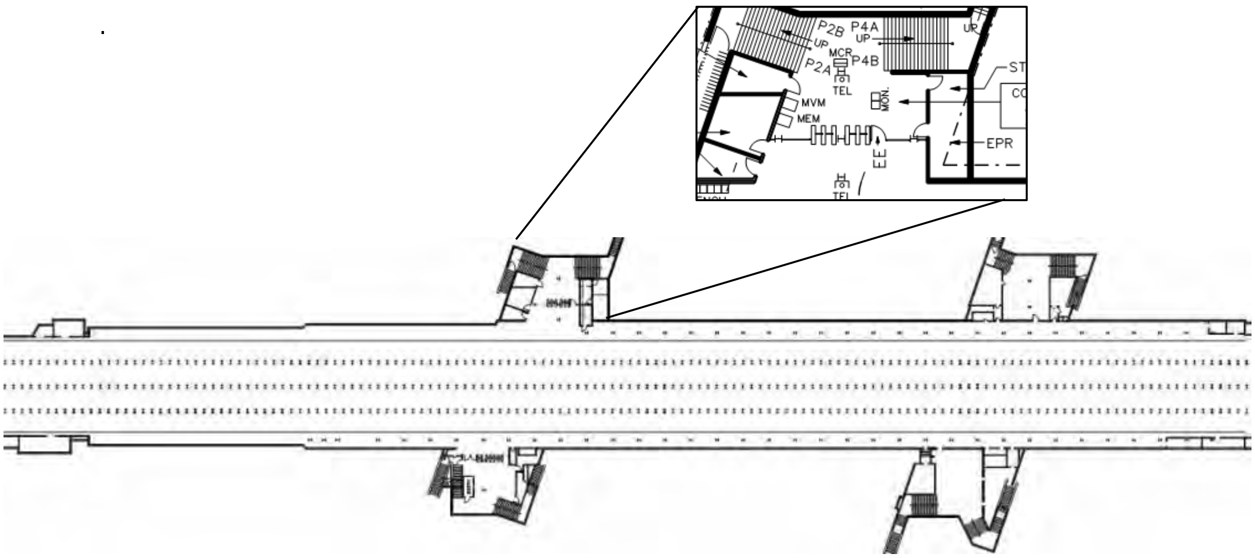

***Figure 1** – Station Plan- 28th Street Station*

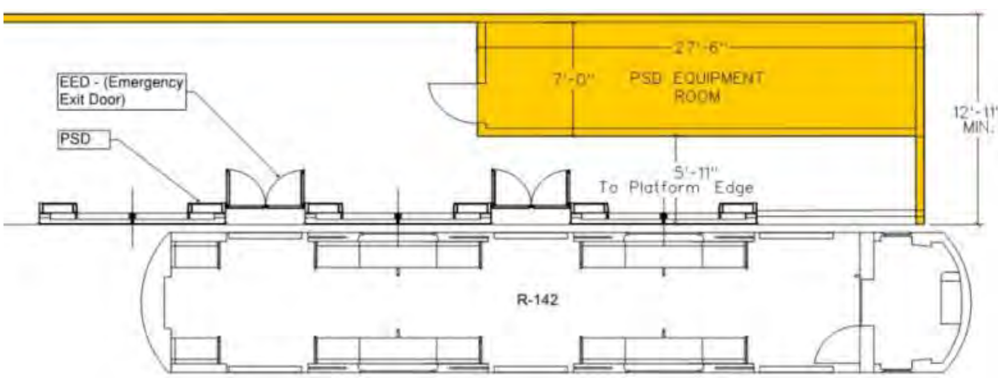

***Figure 2 –** Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimensions)

1.14 – MR 014 | 23rd Street

Summary: *23rd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at the northbound platform control area as the remaining width would be 27" (see figure 1).*

Description

23rd Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns 3'-8" from the platform edge at each platform. The platform width varies from 6'-0" to 11'-2" in width. The entry / exit turnstiles at the south entrance of the northbound platform are positioned with minimal clearance of 18" to the adjacent columns. The remaining space between the columns and the platform edge measures 42". The implementation of a platform edge barrier would reduce this width to 27" or less* which would not allow for ADA compliant wheelchair movement. See figures 1and 2 below. The plan in figure 1 demonstrates that there is no alternative location for the turnstiles / railings.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

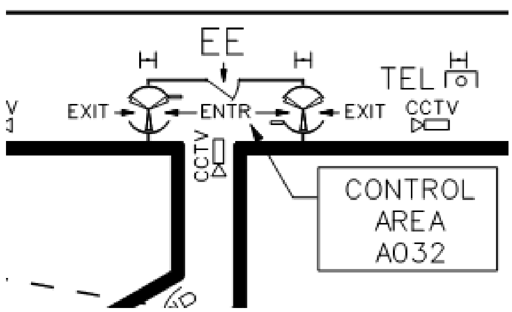

***Figure 1** – Non-Compliant ADA condition - 23rd Street*

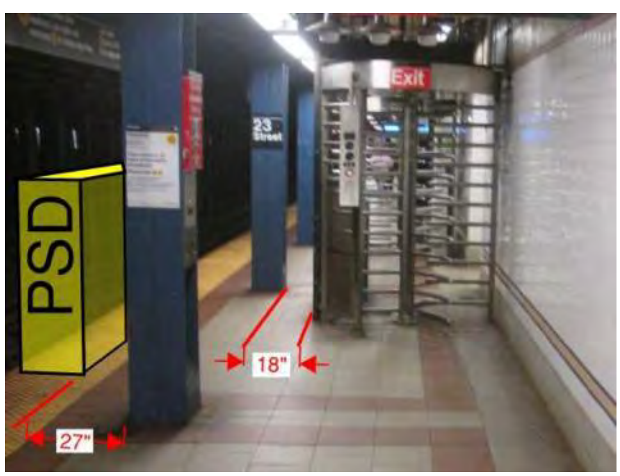

***Figure 2** – Non-Compliant ADA condition - 23rd Street*

1.15 – MR 015 | 14th Street / Union Square Station

Summary: *14th Street / Union Square Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 27" (see figure 1). (Note: this report covers only the Broadway BMT platforms; see reports for the L-line and 4,5,6-line for the remainder of this complex)*

Description

14th Street / Union Square Station is a below-grade station consisting of two center / island platforms. The platform width is 18-8" throughout. The platforms are straight with two rows of columns at 3'-6" from edge of platform; these columns flank multiple staircases. The implementation of a platform edge barrier would reduce this width to 27" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
14th Street / Union Square

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1.16 – MR 016 | 8th Street Station

Summary: *8th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1).*

Description

8th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns 3'-4" from the platform edge at each platform. The platform width varies from 9'-6" to 11'-0" in width. The south street stair at each platform is positioned with minimal clearance to the adjacent columns. The remaining space between the columns and the platform edge measures 40". The implementation of a platform edge barrier would reduce this width to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 below.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
8th Street Station

1.17 – MR 017 | Prince Street Station

Summary: *Prince Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 21" (see figure 1).*

Description

Prince Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 7'-6' to 8'-8". Platform width at the south end of the southbound platform is 36". The implementation of a platform edge barrier would reduce this width to 21" or less* which would not allow for ADA compliant wheelchair movement.. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
Prince Street

1.18 – MR 018 | Canal Street Station Upper Level

Summary: *Canal Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 33" (see figure 1).*

Description

Canal Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 7'-0' to 11'-8". Platform width at the south end of the northbound platform is 48". The implementation of a platform edge barrier would reduce this width to 33" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
Canal Street Station

1.19 – MR 019 | Canal Street Station Lower Level

***Summary:** Canal Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

Canal Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The typical width of the platforms ranges from 7'-0' to 9'-6". Platform widths are not wide enough to accommodate an equipment room (Figure 2) and the mezzanine cannot accommodate a full-size equipment room without constraining passenger flow.

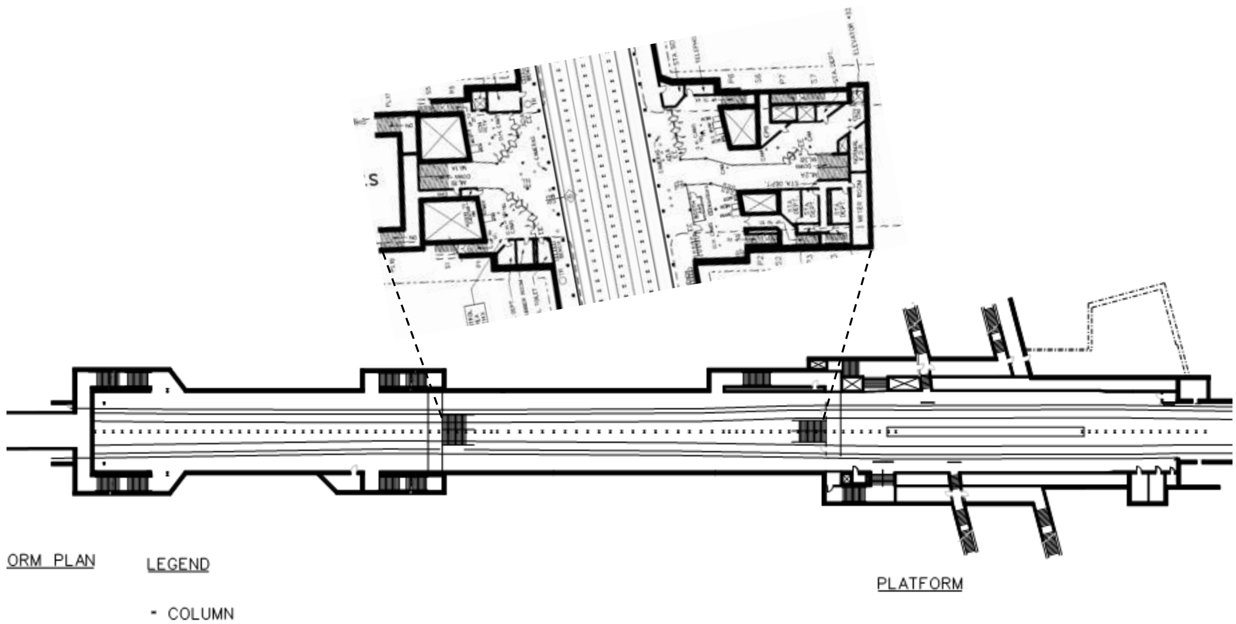

***Figure 1** – Station layout showing lack of space*
Canal Street Station Lower Level – Mezzanine shown above

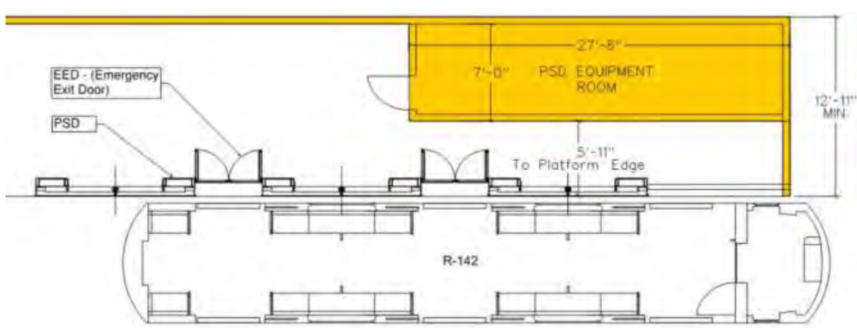

***Figure 2 –** Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimensions)

1.20 – MR 020 | City Hall Station

Summary: *City Hall Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1).*

Description

City Hall Station is a below-grade station with a center / island platform. The platform structure is cast-in-place concrete. The platform width varies from 23'-8" to 46'-4". There are four lines of columns, with those adjacent to the track being 3'-4" from the platform edge. Ceiling heights measure no less than 7'-6" throughout. At the stair to the lower level, clearance along the platform edge is constricted by columns subdividing the space into two narrow widths. The available 40" width between columns and platform edge will be further constricted by the introduction of PSDs, reducing the width to 25" or less* which would not allow for ADA compliant wheelchair movement. See Figure 1 below.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
City Hall Station

1.21 – MR 021 | Cortlandt Street Station

Summary: *Cortlandt Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the northbound platform as the existing width is 5'-3"" (see figure 1).*

Description

Cortlandt Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-3' to 19'-8". There are two ceiling-mounted signals at each platform at a minimum 6'-11" clearance.

Platform width at the south end of the northbound platform is 5'-3". The installation of a platform edge barrier will reduce the width to 48" or less*. Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant code condition*
Cortlandt Street Station

1.22 – MR 022 | Rector Street Station

Summary: *Rector Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at the northbound control area as the remaining width would be 25" (see figure 1).*

Description

Rector Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 10'-2' to 11'-8". At the turnstile line on the northbound platform, clearance between the turnstiles and the row of columns is only 20". At this area there is 40" between the columns and the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 32" for a pinch point. The remaining 25" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference. The plan of this area shown in Figure 2 reveals the constrained conditions within the unpaid area and demonstrates that there is no available space for reconfiguration of turnstiles to ameliorate the non-compliant conditions.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant code condition*
Rector Street Station

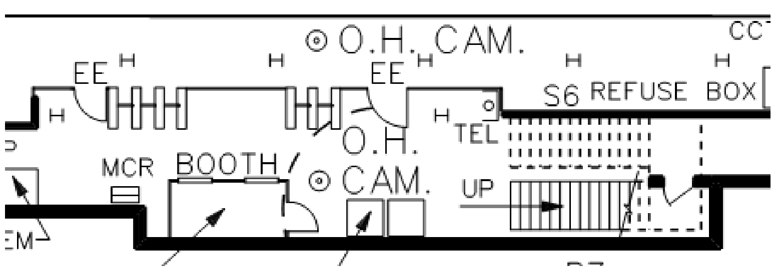

***Figure 2** – Constrained control area; northbound platform*
Rector Street Station

1.23 – MR 023 | Whitehall Street Station

Summary: *Whitehall Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 21" (see figure 1).*

Description

Whitehall Street Station is an underground station consisting two center / island platforms. The platforms are approximately 12'-6" wide throughout. At four staircases, columns flank the stair, leaving a dimension of 36" between the column and the platform edge. The implementation of a platform edge barrier would reduce this width to 21" or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
Whitehall Street Station

1.24 – MR 024 | Court Street Station

Summary: *Court Street Station is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors. (see figure 1).*

Description

The Court Street Station is a below grade station with a center / island platform. The platform structure is cast-in-place concrete. The width of the platform varies from 15'-2" to 19'-2". Several columns are 16" from the platform edge. In that position, the columns block access to the maintenance panels of the PSDs. In addition, the columns impede the ability to open the hinged emergency egress doors which are mounted between every PSD sliding door. **(see Figure 1)**.

Figure 1 – *Obstruction at platform edge*
Court Street Station

1.25 – MR 025 | Jay Street / Metrotech Station

Summary: *Jay Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor width and the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 9" (see figure 1).*

Description

The Jay Street Station is a below grade station with a center / island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 14'-0" throughout. Columns are spaced 13'-0" on center. There is one staircase along the platform adjacent to these columns. The column faces are 24" away from all platform edges. The implementation of a platform edge barrier would reduce this width to 9"" or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. **(see Figure 1)**.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Non-Compliant ADA condition*
Jay Street Station

1.26 – MR 026 | Dekalb Ave Station

Summary: *Dekalb Ave Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Dekalb Ave Station is a below-grade station with center / island platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. The platform columns are spaced 10'-10" on center, and column faces typically measure 1'-6". The platform width is 15'-8" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

Since there are 4 platform edges at this station, 2 full size equipment rooms would be required. The equipment room for N line could be located at the south mezzanine. A second adjacent equipment room would serve the other two platforms which handle other train service. (**Figure 1 & Figure 2).** The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

This platform edge was re-constructed within the last twenty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system.

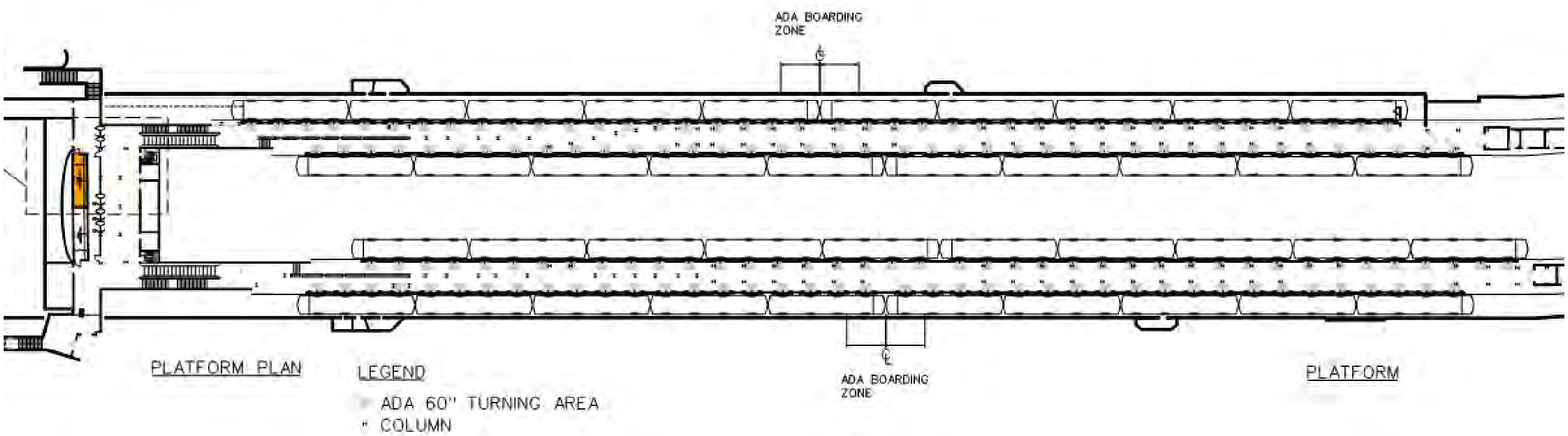

***Figure 1** – Overall Station Plan*
Dekalb Station

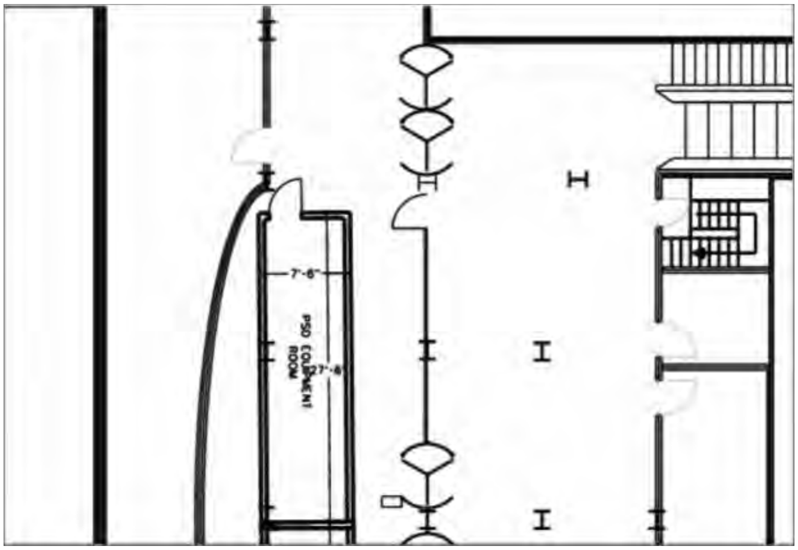

Figure 2 *– PSD Equipment Room 1 Detail*
Dekalb Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 & 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Dekalb Avenue Flatbush Ave
Peak Demand Load from ConEd Report, (kW)	95.2
Apparent Power (kVA)	119.0
Station Peak Demand Load, Max Current, (A)	330.6
Maximum Number of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	671
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	529
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1-line diagram, having 1200A fuses at Service switch. Station has (2) separate meter readings each for Normal & Reserve service. This analysis is for **Normal service**.

Table 1. Power Capacity Analysis (Normal Service)

Station
Power Capacity Analysis

Station Name	Dekalb Avenue Flatbush Ave
Peak Demand Load from ConEd Report, (kW)	73.6
Apparent Power (kVA)	92.0
Station Peak Demand Load, Max Current, (A)	255.6
Maximum Number of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	596
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	604
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1-line diagram, having 1200A fuses at Service switch. Station has (2) separate meter readings each for Normal & Reserve service. This analysis is for **Reserve service**.

Table 2. Power Capacity Analysis (Reserve Service)

Historic Restrictions:
None.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions is listed in the attached ROM estimate. The total cost for this station is estimated to be $32.2M to install APGs and $41.4M to install PSDs (See Appendix E).

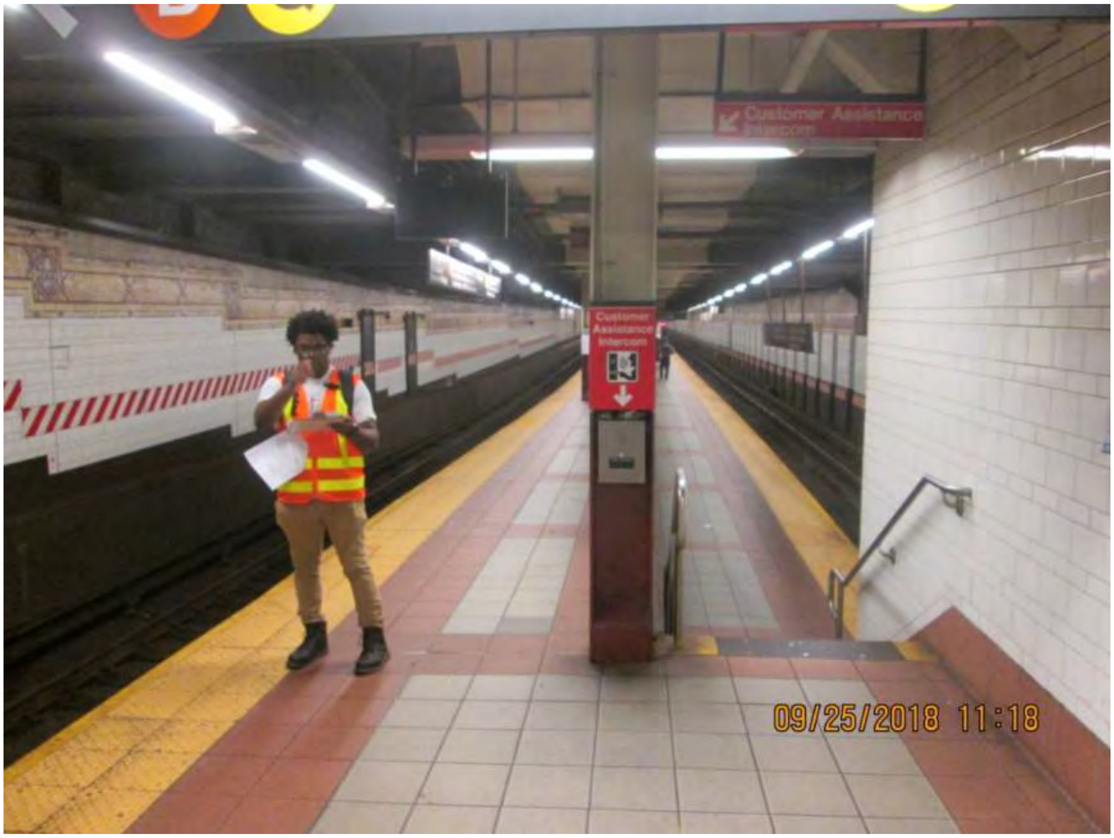

***Figure 3** – Typical platform view*
Dekalb Station

1.27 – MR 027 | Atlantic Ave Station

Summary: *Atlantic Ave Station is feasible for both APGs and PSDs. At the southbound platform, two columns adjacent to the platform edge would require removal and replacement at a more distant location. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Atlantic Ave Station is a below grade with two side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. The platform columns are spaced 15'-1/2" on center, and column faces are at varying distances from the platform edge. The platform width is 18'-8" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

Since there are 4 platform edges at this station, 2 full size equipment rooms would be required. The equipment rooms could be located at the south mezzanine. (**Figure 1 & Figure 2).** The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

This platform edge was re-constructed within the last twenty-five years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system.

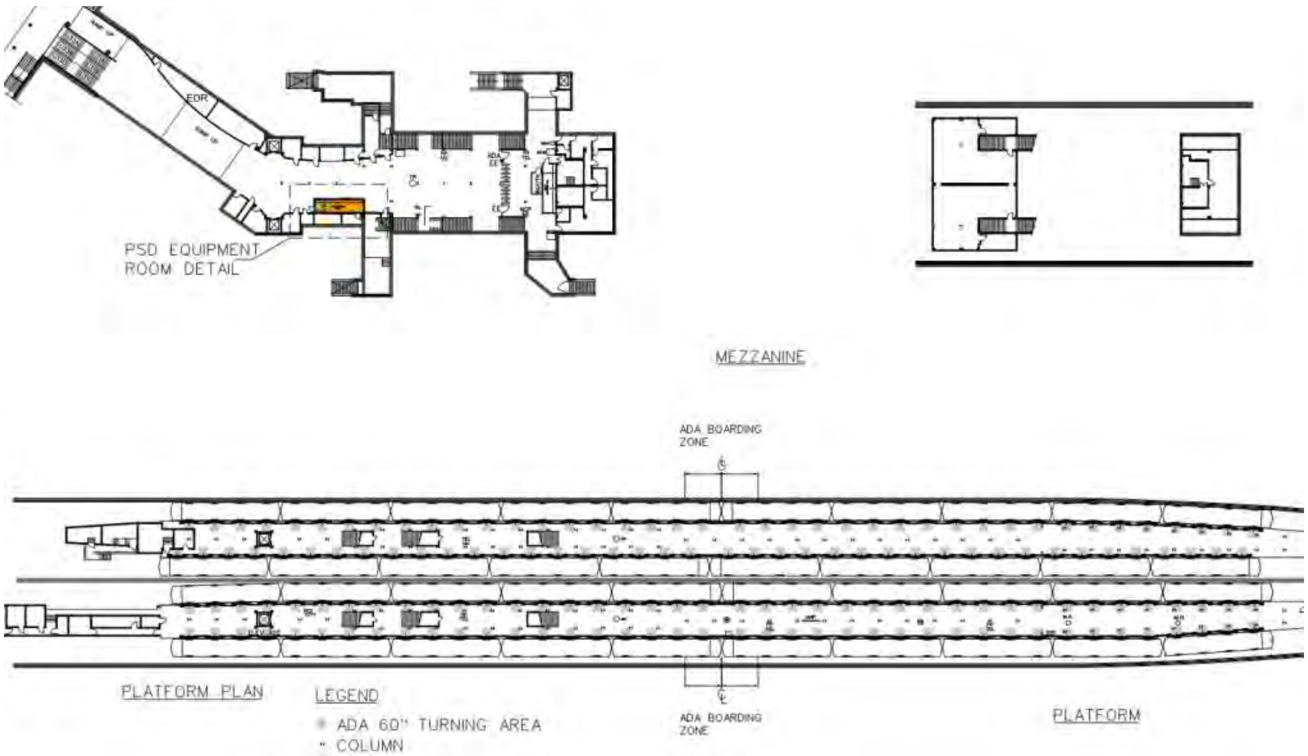

Figure 1 *– Overall Station Plan*
Atlantic Ave Station

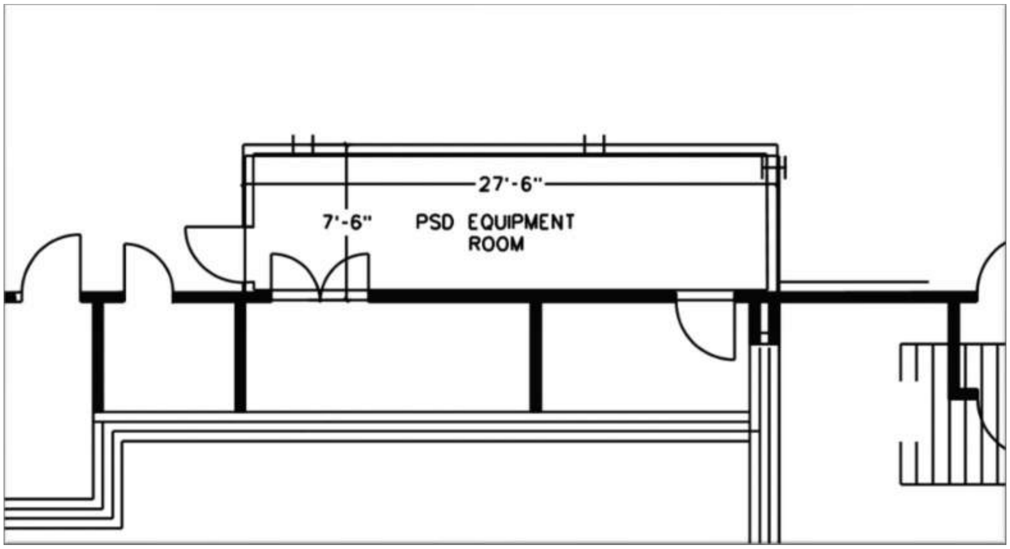

***Figure 2** – PSD Equipment Room 1 Detail*
Atlantic Ave Station

Platform obstructions within 5' of edge:

Southbound Track:

- One column is at 1'-0" from each platform edge. They will require removal and replacement as part of any PSD installation.

Northbound Track:

- None

These obstructions do not present an impediment to the installation of PSDs beyond the instances mentioned above.

Historic Restrictions:

The Atlantic Avenue station is a historically designated property. As such, design will require review by the New York State Historical Preservation Office.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis

Station Name	Atlantic Ave. Barclays Ctr.
Peak Demand Load from ConEd Report, (kW)	88.8
Apparent Power (kVA)	111.0
Station Peak Demand Load, Max Current, (A)	308.3
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	649
Station Service Power Capacity, (Main SB or SG Rating), (A)	1600
Service Spare Capacity, (A)	951
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 1600A fuses at Service switch. Station has (2) separate meter readings each for Normal & Reserve service. This analysis is for **Normal service**.

Table 1- *Power Capacity Analysis (Normal Service)*

Station Power Capacity Analysis

NYCT Station MR Number	27
Station Name	Atlantic Ave. Barclays Ctr.
Peak Demand Load from ConEd Report, (kW)	55.2
Apparent Power (kVA)	69.0
Station Peak Demand Load, Max Current, (A)	191.7
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	532
Station Service Power Capacity, (Main SB or SG Rating), (A)	1600
Service Spare Capacity, (A)	1068
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 1600A fuses at Service switch. Station has (2) separate meter readings each for Normal & Reserve service. This analysis is for **Reserve service**.

Table 1- *Power Capacity Analysis (Reserve Service)*

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.3M to install APGs and $39.9M to install PSDs (See Appendix E).

***Figure 3** – View of column at platform edge requiring removal and replacement*
Atlantic Ave Station

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1.28 – MR 028 | Union Street Station

Summary: *Union Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

Union Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns 2'-6" from the platform edge at each platform, at the northern third of the stations. The remainder of the platform is column-free. The platform width is 8'-8" throughout. Due to the extremely limited width of the existing platforms and control areas, there is no available space for the equipment room. Figure 2 below shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the northbound control area. The southbound control area is similar.

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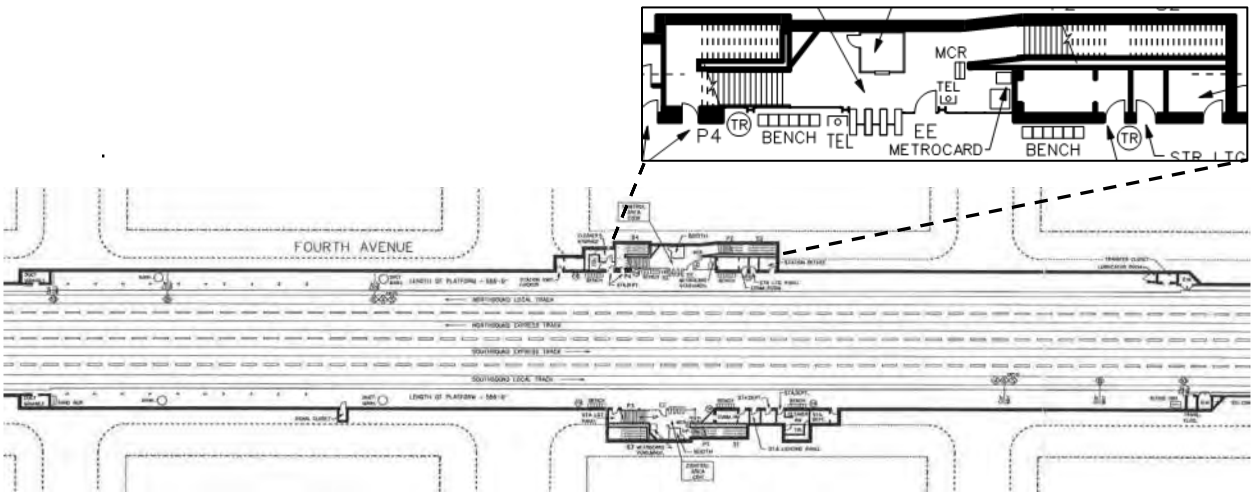

***Figure 1 –** Congested/Narrow Station Plan*
Union Street Station

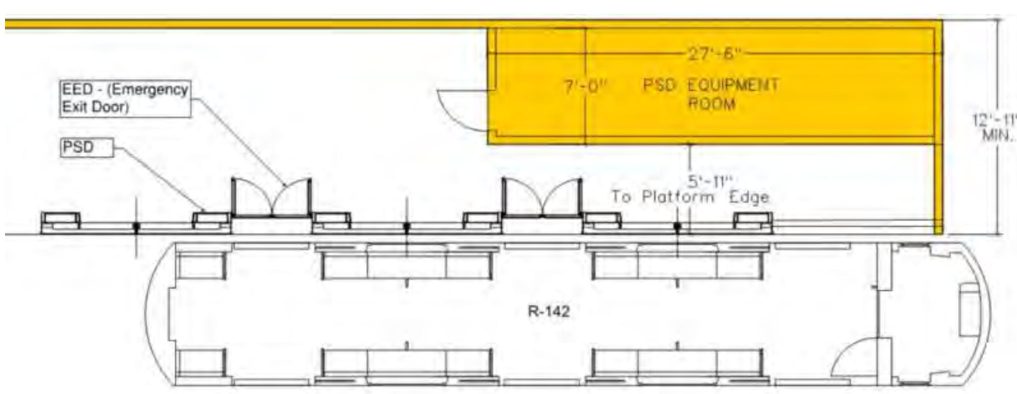

***Figure 2 –** Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimensions)

1.29 – MR 029 | 4th Ave / 9th St Station

Summary: *4th Ave / 9th St Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

4th Ave 9th St Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 8'-4" to 8'-8"." Columns are spaced 11'-10" on center with column faces 3'-0" away from the edge. The columns are present only on the northern third of both the platforms; the remainder of the platforms are column-free. Due to the extremely limited width of the existing platforms and control areas, there is no available space for the equipment room. Figure 2, below, shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the northbound control area. The southbound control area is similar.

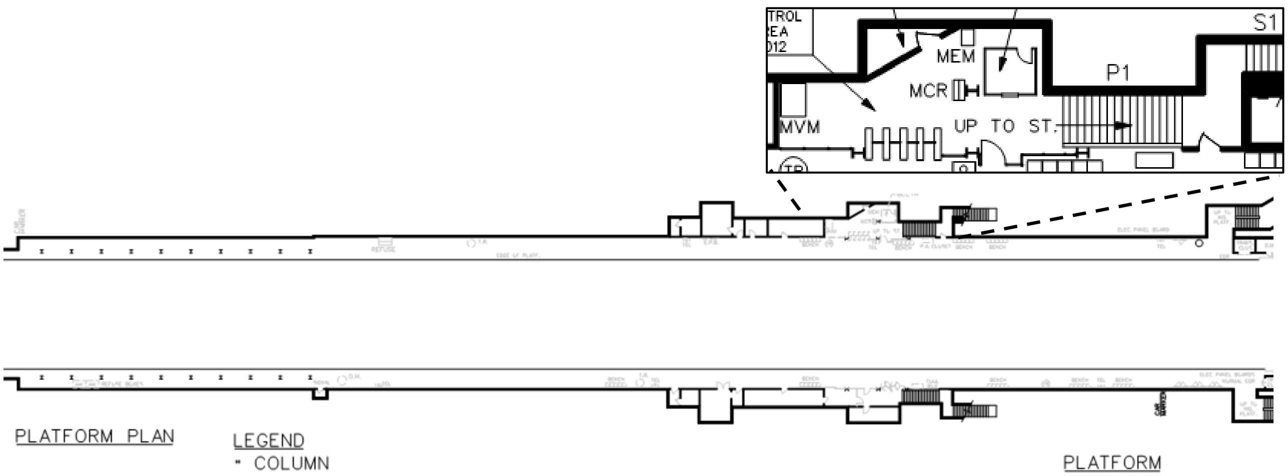

Figure 1 – *Congested/Narrow Station Plan*
4th Ave / 9th Street Station

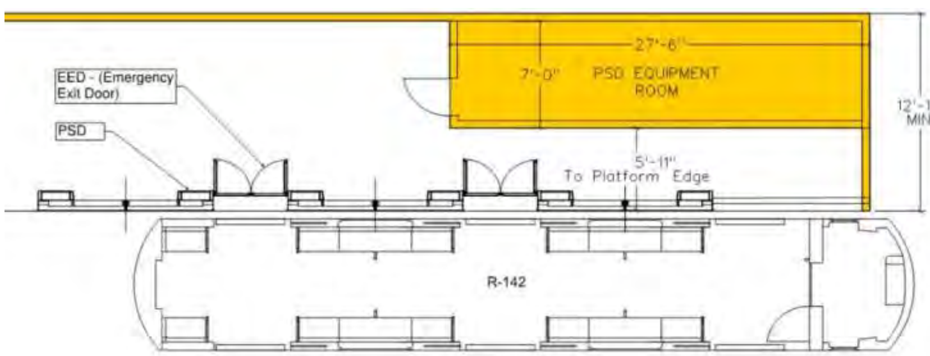

Figure 2 – *Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimensions)

1.30 – MR 030 | Prospect Avenue Station

Summary: *Prospect Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

The Prospect Ave Station is a below-grade station with two side platforms. The platform structure is cast-in-place concrete. The width of the platform is approximately 8'-4" throughout. Columns occupy only the northern third of the platforms with column faces 2'-4" away from the platform edge. Due to the extremely limited width of the existing platforms and control areas, there is no available space for an equipment room. Figure 2, below, shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the northbound control area. The southbound control area is similar.

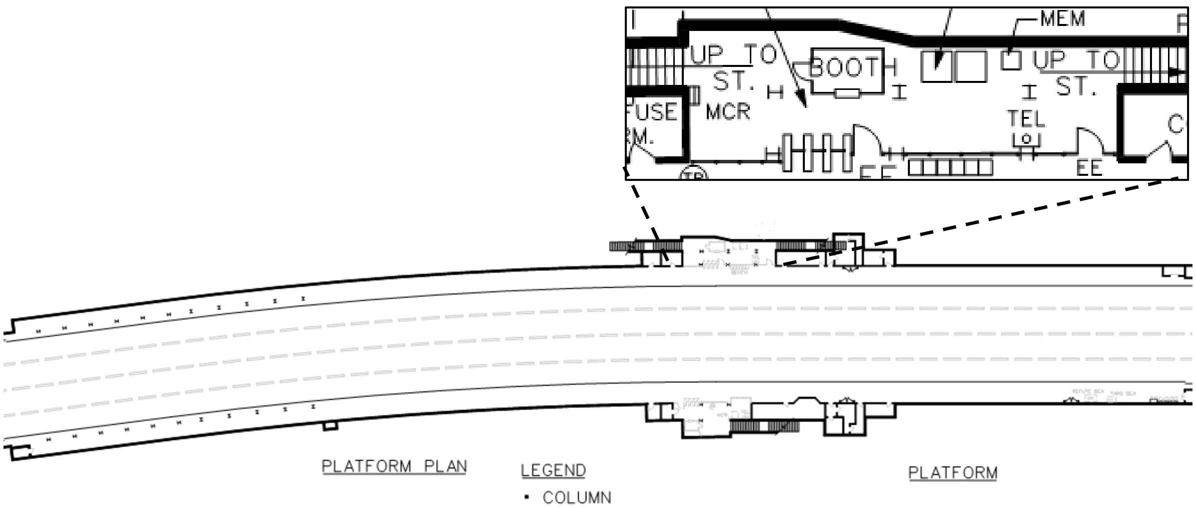

Figure 1 – *Congested/Narrow Station Plan*
Prospect Avenue Station

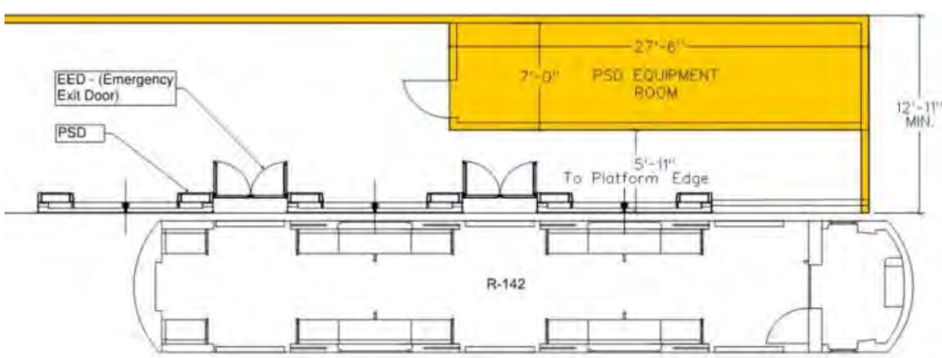

Figure 2 – *Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimensions)

1.31 – MR 031 | 25th Street Station

Summary: *25th Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

25th Street Station is a below grade station with two side platforms. The platform structure is cast-in-place concrete. The width of the platform is approximately 8'-4" throughout. Columns occupy only the northern third of the platforms with column faces 2'-4" away from the platform edge. Due to the extremely limited width of the existing platforms, there is no available space for an equipment room. Figure 2, below, shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the northbound control area. The southbound control area is similar.

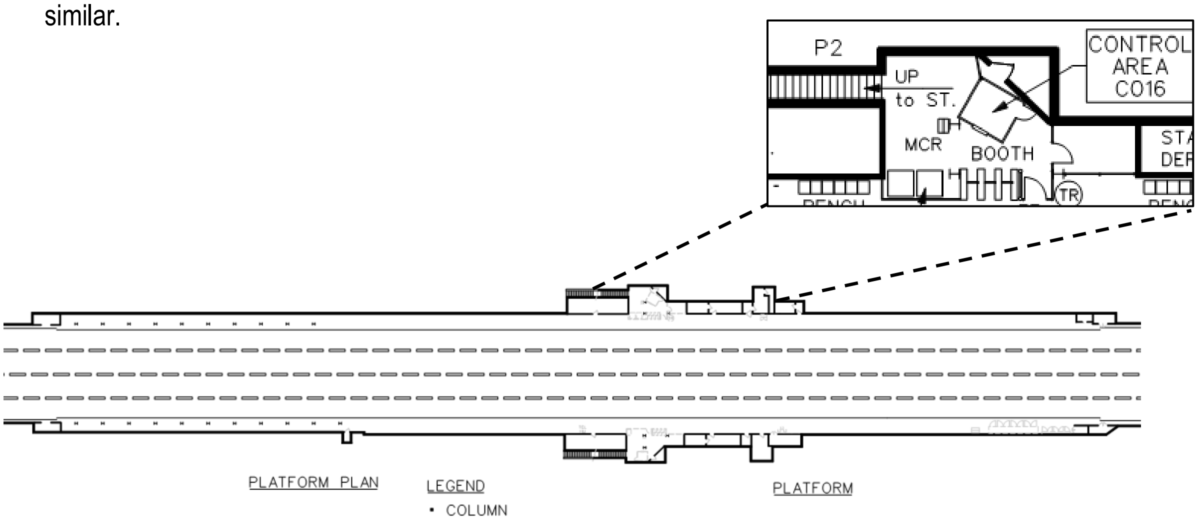

***Figure 1 –** Congested/Narrow Station Plan*
25th Street Station

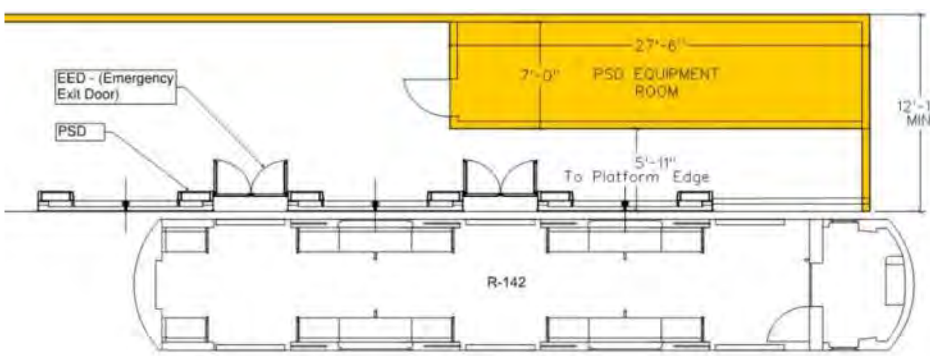

***Figure 2 –** Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimensions)

1.32 – MR 032 |36th Street Station

Summary: *36th Street Station is not feasible for both APGs and PSDs due to the row of columns at 12" from the platform edge. The barrier itself is15" thick and requires free space for maintenance purposes. (see figure 1).*

Description

The 36th Street Station is a below grade station with two center / island platforms. The platform structure is cast-in-place concrete. The width of the platforms varies from 13'-0" to 19'-2". Columns are spaced 15'-6" on center with column faces 1'-0" away from all platform edges. The inside face of the barrier itself is 15" minimum from the concrete platform edge, and requires free space for maintenance and operation. **(see Figure 1)**.

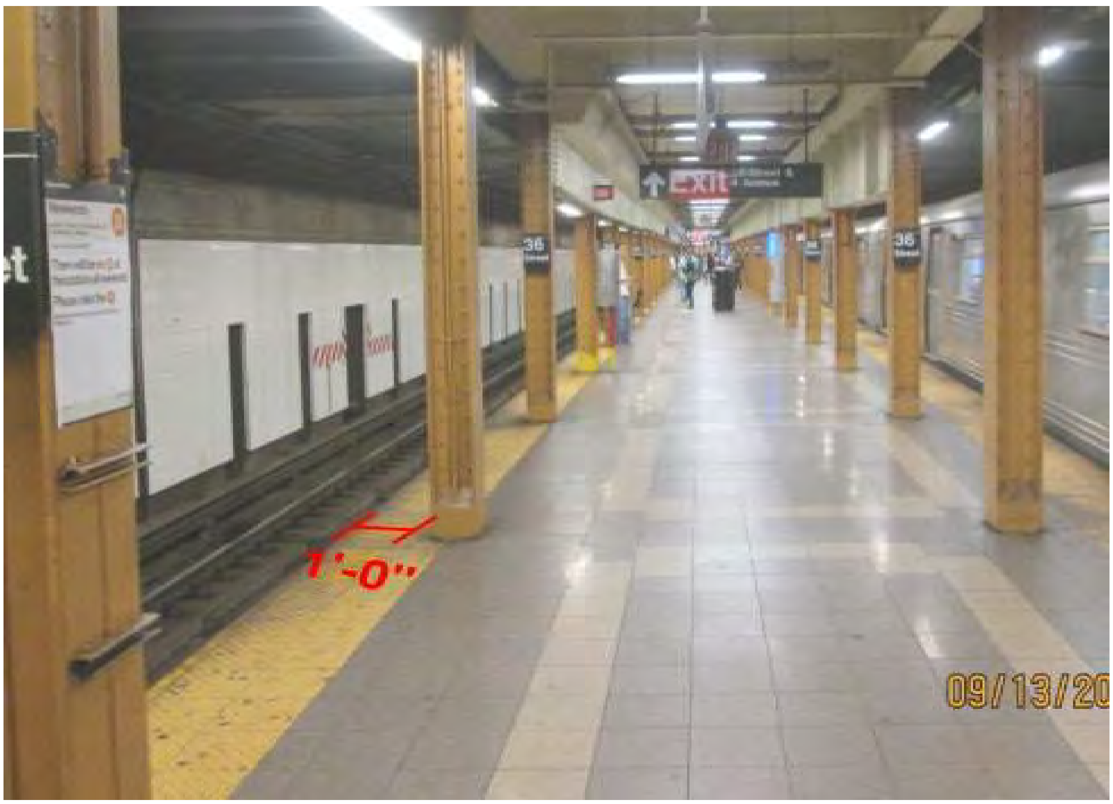

Figure 1 – *Obstruction within 12"*
36th Street

1.33 – MR 033 | 45th Street Station

Summary: *45th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs/walls as the remaining width would be 25" (see figure 1).*

Description

The 45th Street Station is a below grade station with two side straight platforms. The platform structure is cast-in-place concrete. The width of the platform varies 10'-8" to 15'-6". There is one room along the southbound platform which would constrain wheelchair movement with PSDs installed. Columns are spaced 15'-6" on center with column faces 3'-0" away from all platform edges. The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 25" or less* would not allow for ADA compliant wheelchair movement. **(see Figure 1)**.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Non-Compliant ADA condition*
45th Street Station

1.34 – MR 034 | 53rd Street Station

Summary: *53rd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs/wall as the remaining width would be 23" (see figure 1).*

Description

The 53rd Street Station is a below grade station with two side straight platforms. The platform structure is cast-in-place concrete. The width of the platform varies 9'-6" to 10'-10". There is one staircase along the southbound platform which would constrain wheelchair movement with PSDs installed. Columns are spaced 15'-2" on center with column faces 3'-2" away from all platform edges. The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 23"or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. **(see Figure 1)**.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1 –** Non-Compliant ADA condition*
53rd Street Station

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1.35 – MR 035 | 59th Street Station

Summary: *59th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 33" (see figure 1).*

Description

The 59th Street Station is a below grade station with two center / island platforms. The platform structure is cast-in-place concrete. The width of the platform is varying 12'-8" to 17'-10". There is one staircase along the southbound platform which would constrain wheelchair movement with PSDs installed. Columns are spaced 15'-1" on center with column faces 3'-0" away from all platform edges. The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 33" or less* would not allow for ADA compliant wheelchair movement. **(see Figure 1)**.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

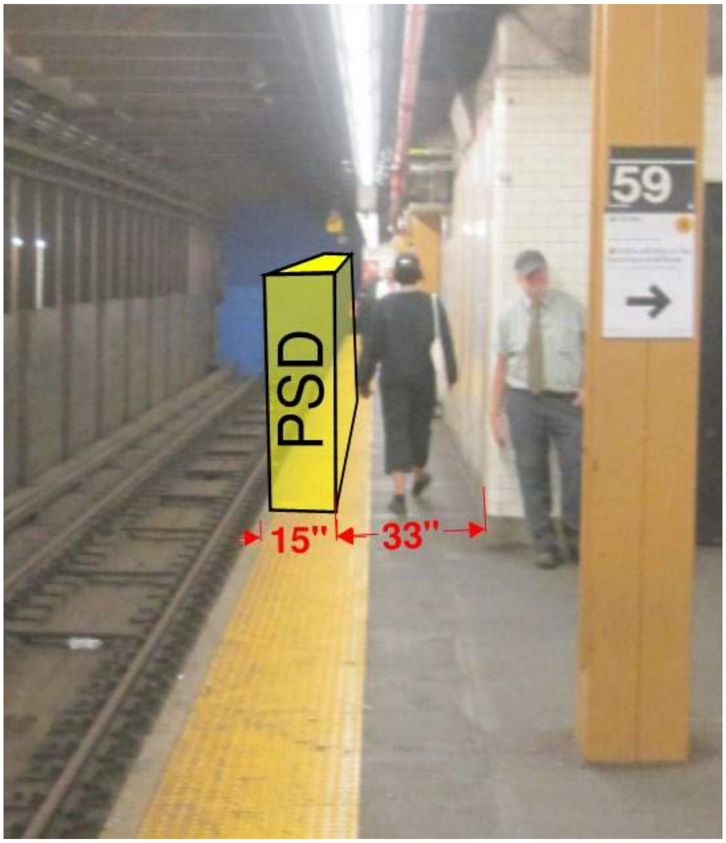

***Figure 1 –** Non-Compliant ADA condition*
59th Street Station

1.36 – MR 058 Coney Island-Stillwell Avenue Station

Summary: *Coney Island-Stillwell Avenue Station is feasible for both APGs and PSDs. This station is the terminus station for the 'N', 'Q', 'D', and 'F' trains. Tracks 1 and 2 serve the N line from a shared center / island platform. The canopy at this station is very tall, and there are no structural members directly above the platform edge. For the installation of a full height PSD system, structural members would have to be attached to existing beams that are approximately 12'-0" high and 5'-0" from the platform edge. One and a half train cars are not covered by a canopy. Therefore, a supplemental overhead structure would be needed in this part of the platform. Platform edge reconstruction will be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Coney Island-Stillwell Avenue Station is an elevated station with four center/island platforms. Each train that is served at this station has a center/island platform for its use only. The 'N' line platform is mostly straight, but tapers at the north-end of the platform. The platform structure is made of cast-in-place concrete. There are two stairs and a centrally located ramp that provide access to the mezzanine level below. There are two rows of columns along the length of the platform. These columns are spaced approximately 20'-0" on center with column faces 6'-10" from the platform edge. The platform varies from 20'-0" to 26'-0" wide. One and a half train cars are not covered by the canopy. A supplementary overhead structure would be required in these locations to accommodate a platform edge barrier. See figure 1 for an overall station plan.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. As indicated in the summary, there is not structure to mount to directly above the platform edge, some additional framing would be needed in this station (see figure 3).

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, entrapment prevention sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be CCTV cameras over each motorized sliding door which will need to be in coordination with existing or replacement lighting. Minimal overhead structure would be needed to accommodate cameras and sensors in the small portion of the platforms not covered by canopies

Equipment Room

One room can be accommodated on the platform between columns at the center of the platform. The proposed room would measure approximately 16'-0" x 7'-6" (see figure 2). The other lines that are served at this station could use a similar room location on their respective platform (see figure 1)

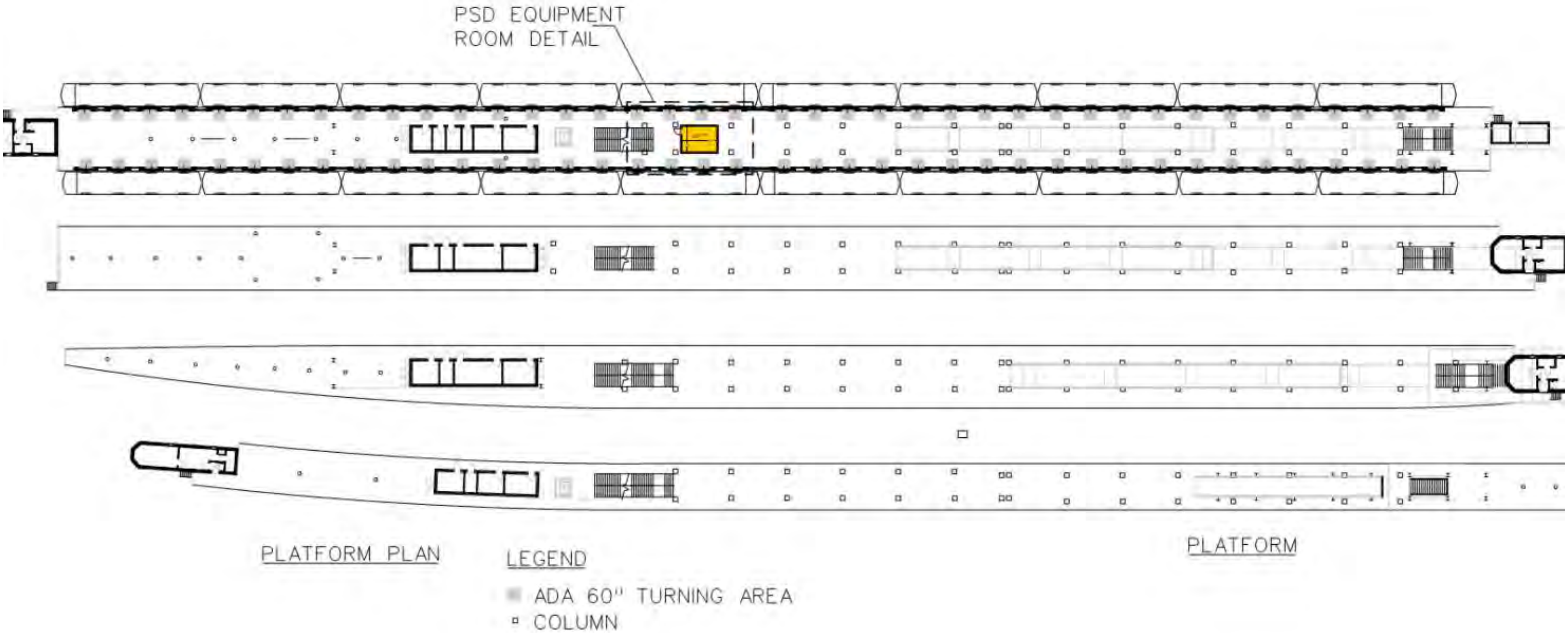

***Figure 1** – Station Plan*
Coney Island-Stillwell Avenue Station

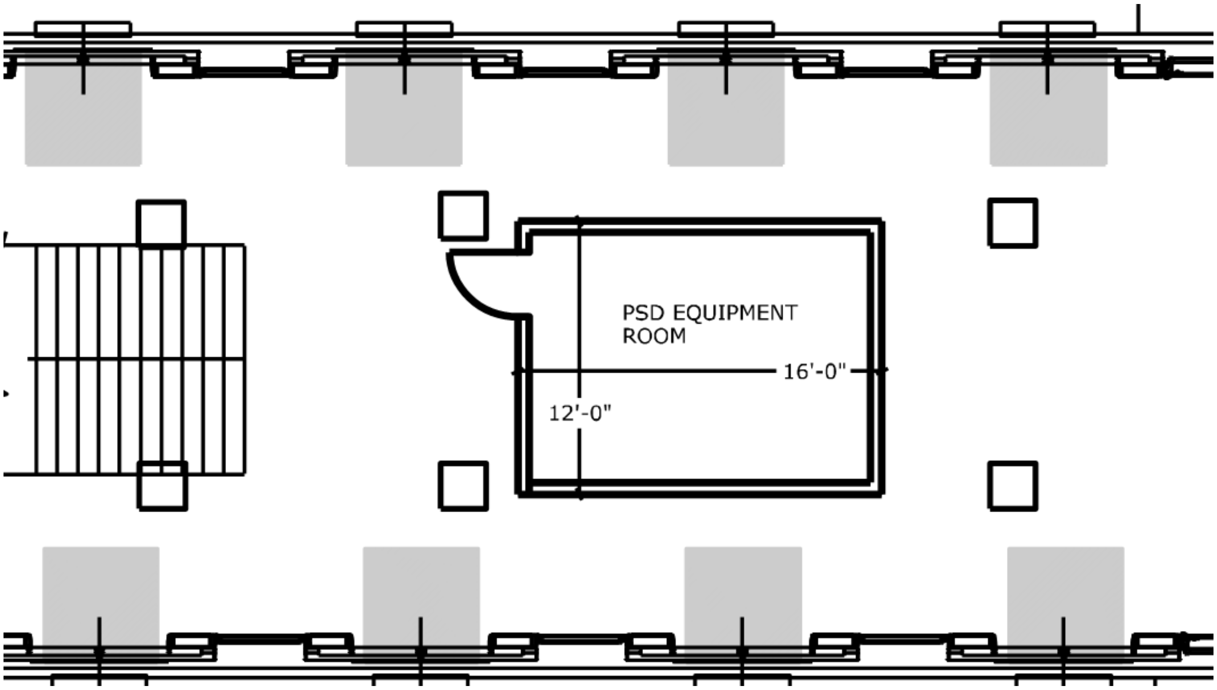

***Figure 2** – PSD Equipment Room Detail*
Coney Island-Stillwell Avenue Station

Track Layout

Tracks are mostly tangent with the exception of the tapered north-end of the platform. Thus, we are expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

The platform edges were reconstructed in 2004. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, reconstruction of the concrete platform edge will be required only for the installation of an APG system.

Platform obstructions within 5' of edge:

None.

Lighting:

Existing lighting: Linear fluorescent lights are mounted below the beams that run parallel to the platform. These beams are approximately 12'-0" high and 5'-0" from the edge of the platform. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

The existing Reserve electrical service is adequate for the installation of PSD/APG's. However, the Normal service is not adequate and therefore would not serve as a back-up system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 and Table 2 please see the Power Capacity Analysis for this station.

Station (Normal)
Power Capacity Analysis

Station Name	Coney Island Stillwell / Surf Ave
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	552.0
Apparent Power (kVA)	690.0
Station Peak Demand Load, Max Current, (A)	1916.7
Maximum Amount of Doors	320.0
PSD Total Load Including All Miscellaneous Loads, (A)	632.6
Total Load (Station Peak + PSD), (A)	2549
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	0
Is Electrical Service Adequate?	**No**
Notes	This is for Normal service only. Station has (2) separate meter readings (not combined). Normal service has exceeded its service rating. **NO** additional load be connected to this normal service.

Table 1. Power Capacity Analysis (Normal Service)

Station (Reserve)
Power Capacity Analysis

Station Name	Coney Island Stillwell / Surf Ave
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	112.0
Apparent Power (kVA)	140.0
Station Peak Demand Load, Max Current, (A)	388.9
Maximum Amount of Doors	320.0
PSD Total Load Including All Miscellaneous Loads, (A)	632.6
Total Load (Station Peak + PSD), (A)	1022
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	179
Is Electrical Service Adequate?	Yes
Notes	This is for Reserve service only. This is based on assumption that each Service is separate. Reserve service has spare capacity. (Normal service has **NO** spare capacity)

Table 2. Power Capacity Analysis (Reserve Service)

Historic Restrictions:
None.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.0M to install APGs and $39.9M to install PSDs (See Appendix E).

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'N' Line Stations
(Coney Island-Stillwell Avenue Station)

Figure 3 *– Typical platform edge condition with line of potential supplementary framing*
Coney Island-Stillwell Avenue Station

1.37 – MR 071 | 8th Ave Station

Summary: *8th Ave is feasible for both APGs and PSDs. At both platforms, one column adjacent to the platform edge would require removal and replacement at a more distant location. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

8th Ave Station is an open cut station with two side curved platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. The platform columns are spaced 12'-0" on center, and column faces typically measure 6". The platform width varies from 11'-0" to 12'-8" throughout. One column on each platform supports the main mezzanine above. These columns stand 1'-0" from the platform edge and would therefore need to be removed and replaced as part of a PSD installation.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

Since there are 2 platform edges at this station, 1 full size equipment rooms would be required. For the planning purposes, the location of the equipment room has been examined to assure feasibility for the station as a whole. The equipment room could be located at the far north end of the mezzanine. (**Figure 1 & Figure 2).** The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are on a mild radius. Therefore, the gaps between the platform and train will slightly exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

This platform edge was re-constructed within the last five years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system.

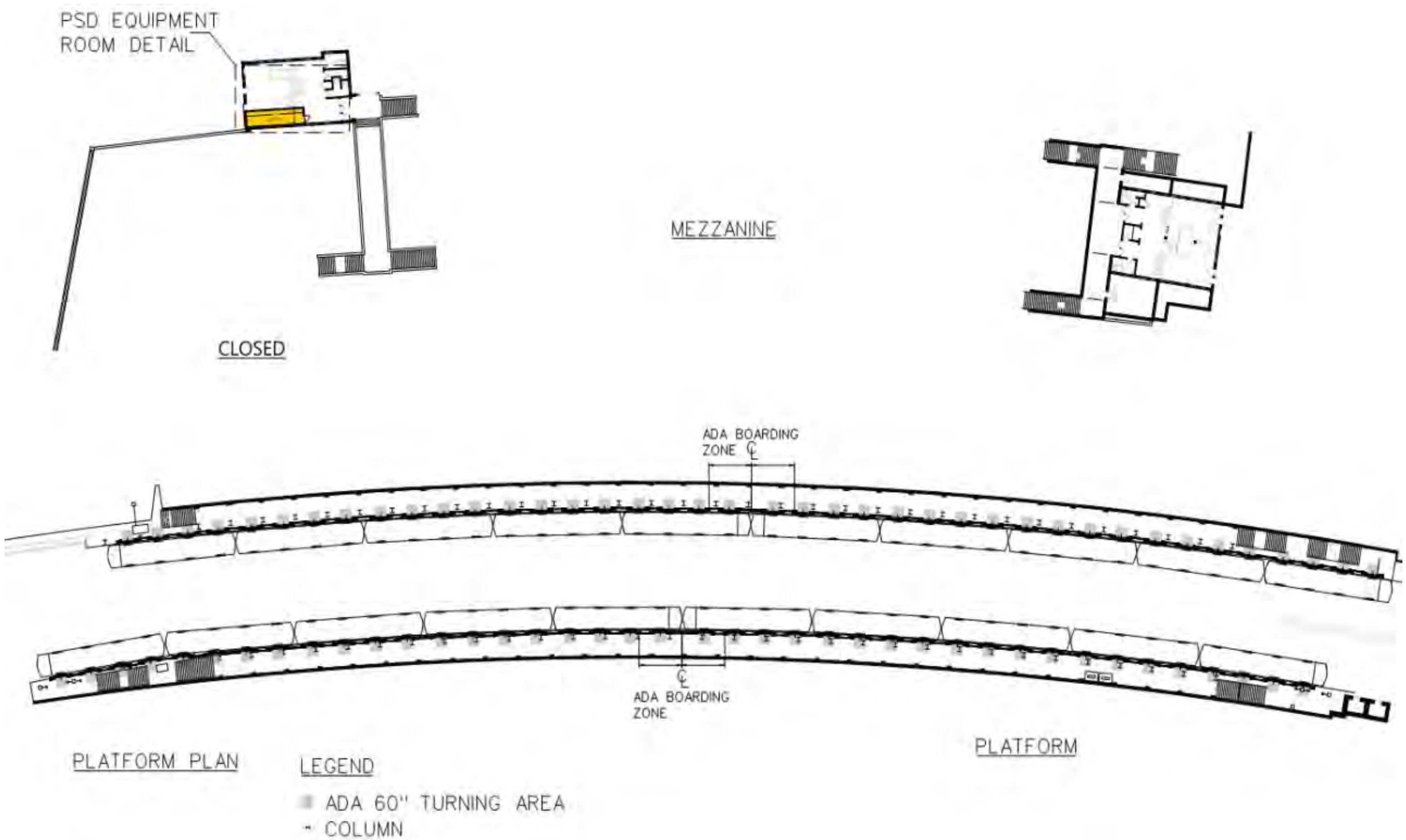

***Figure 1** – Overall Station Plan*
8th Ave Station

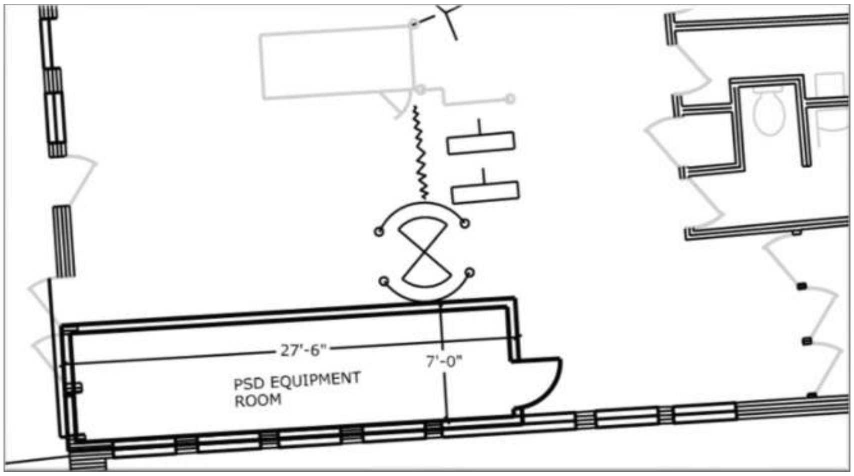

***Figure 2** – PSD Equipment Room 1 Detail*

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

At each platform, one column supporting the mezzanine sits adjacent to the proposed PSD location, making installation infeasible. An installation of PSDs at this station will require structural work to replace the columns at a different location. The remainder of columns do not present an impediment to the installation of PSDs.

Lighting:

Existing lighting: Throughout both platforms there is linear florescent parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 & 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	8th Avenue
Peak Demand Load from ConEd Report, (kW)	75.2
Apparent Power (kVA)	94.0
Station Peak Demand Load, Max Current, (A)	261.1
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	456
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	344
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 800A fuses at Service switch. Station has (2) separate meter readings each for Normal & Reserve service. This analysis is for **Normal service**.

***Table 1**- Power Capacity Analysis (Normal Service)*

Station
Power Capacity Analysis

Station Name	8th Avenue
Peak Demand Load from ConEd Report, (kW)	0.0
Apparent Power (kVA)	0.0
Station Peak Demand Load, Max Current, (A)	0.0
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	195
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	605
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 800A fuses at Service switch. Station has (2) separate meter readings each for Normal & Reserve service. This analysis is for **Reserve service**.

***Table 2**- Power Capacity Analysis (Reserve Service)*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.3M to install APGs and $38.9M to install PSDs (See Appendix E).

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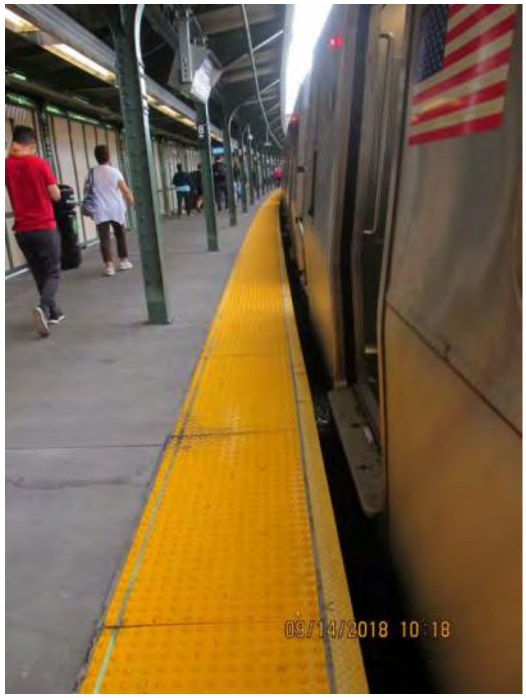

Figure 3 *– Typical platform view*
8th Ave Station

Figure 4 *– Platform column (1 of 2) which will require removal and replacement*
8th Ave Station

1.38 – MR 072 | Fort Hamilton Pkwy Station

Summary: *Fort Hamilton Pkwy Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power capacity could not be ascertained at this station due to ongoing construction. However, a lack of adequate existing power is not considered to be a determining factor of future feasibility.*

Description

Fort Hamilton Pkwy Station is an open cut station with two side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Information on existing drawings indicate that the platform columns on the southbound platform are spaced 12'-0" on center, and column faces are typically 2'-8" from the platform edge. The northbound platform is column-free. The standard platform width is 8'-10" throughout. (Survey was limited to the northbound platform due to ongoing construction)

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

Since there are 2 platform edges at this station, 1 full size equipment rooms would be required. The equipment room could be located at the south mezzanine. (**Figure 1 & Figure 2).** The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

This platform edge was re-constructed within the last five years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system.

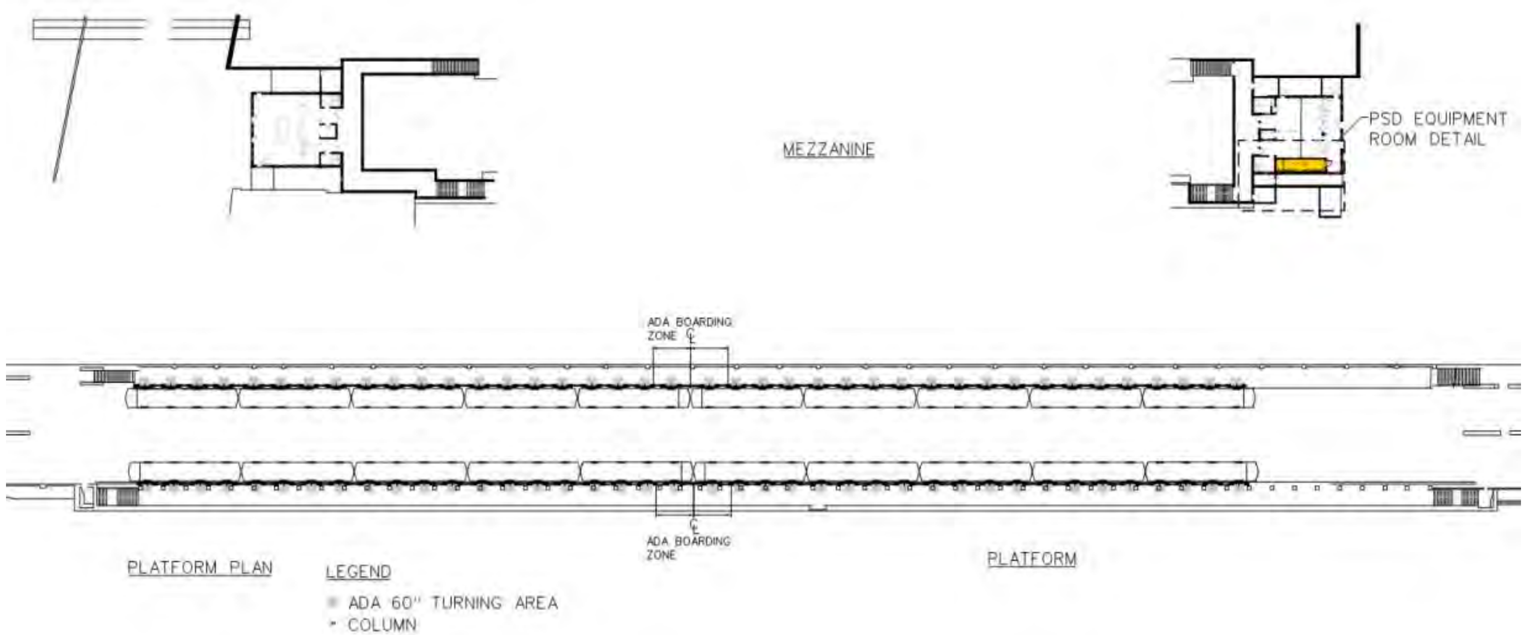

***Figure 1** – Overall Station Plan*
Fort Hamilton Station

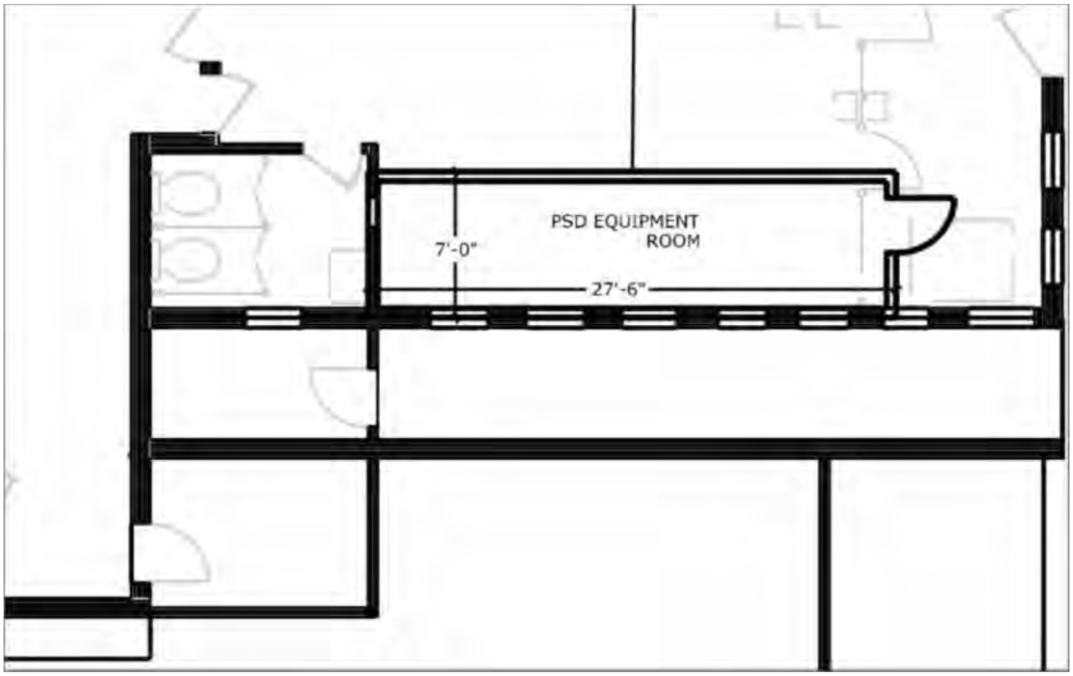

Figure 2 *– PSD Equipment Room 1 Detail*
Fort Hamilton Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- None

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there is linear florescent parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

An analysis of adequate electrical power at this station could not be performed due to inaccessibility during survey. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

***Figure 3** – Typical platform view Fort Hamilton Station*

Historic Restrictions:

None.

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.7M to install APGs and $39.8M to install PSDs (See Appendix E).

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1.39 – MR 073 | New Utrecht Ave

***Summary:** New Utrecht Ave station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 21" (see figure 1).*

Description

The New Utrecht Ave station is an open cut station with two side platforms. The platform structure is cast-in-place concrete. The width of the platform is approximately 12'-2" throughout. There is one staircase along the southbound platform which would constrain wheelchair movement with PSDs installed. Columns are spaced 9'-8" on center with column faces 3'-0" away from all platform edges. The implementation of a platform edge barrier would reduce this width to 21" or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. **(see Figure 1)**.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1 –** Non-Compliant ADA condition*
New Utrecht Avenue

1.40 – MR 074 | 18th Ave Station

Summary: *18th Ave Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 31" (see figure 1).*

Description

The 18th Ave Station is an open cut station with two side platforms. The platform structure is cast-in-place concrete. The width of the platform is approximately 12'-0" throughout. There is one staircase along the southbound platform which would constrain wheelchair movement with PSDs installed. Columns are spaced 12'-0" on center with column faces 3'-10" away from all platform edges. The implementation of a platform edge barrier would reduce this width to 31" or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. **(see Figure 1)**.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Non-Compliant ADA condition*
18th Avenue Station

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1.41– MR 075 | 20th Ave Station

Summary: *20th Ave Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 21" (see figure 1).*

Description

20th Ave Station is an open cut station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns 3'-0" from the platform edge at each platform. The platform width is approximately 12'-0" throughout. There is one staircase along the southbound platform which would constrain wheelchair movement with PSDs installed. Columns are spaced 12'-2" on center with column faces 3'-0" away from all platform edges. The implementation of a platform edge barrier would reduce this width to 21" or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. **(see Figure 1)**.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Plan of proposed PSD equipment room*
20th Ave Station

1.42 – MR 076 | Bay Parkway Station

Summary: *Bay Parkway is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Bay Parkway Station is open cut construction with two side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. The platform columns are spaced 12'-0" on center, and column faces typically measure 1'-4". The standard platform width is 12'-0" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

Since there are 2 platform edges at this station, 1 full size equipment room would be required. The equipment room could be located at the far south end of the mezzanine. (**Figure 1 & Figure 2).** The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

This platform edge was re-constructed within the last five years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system.

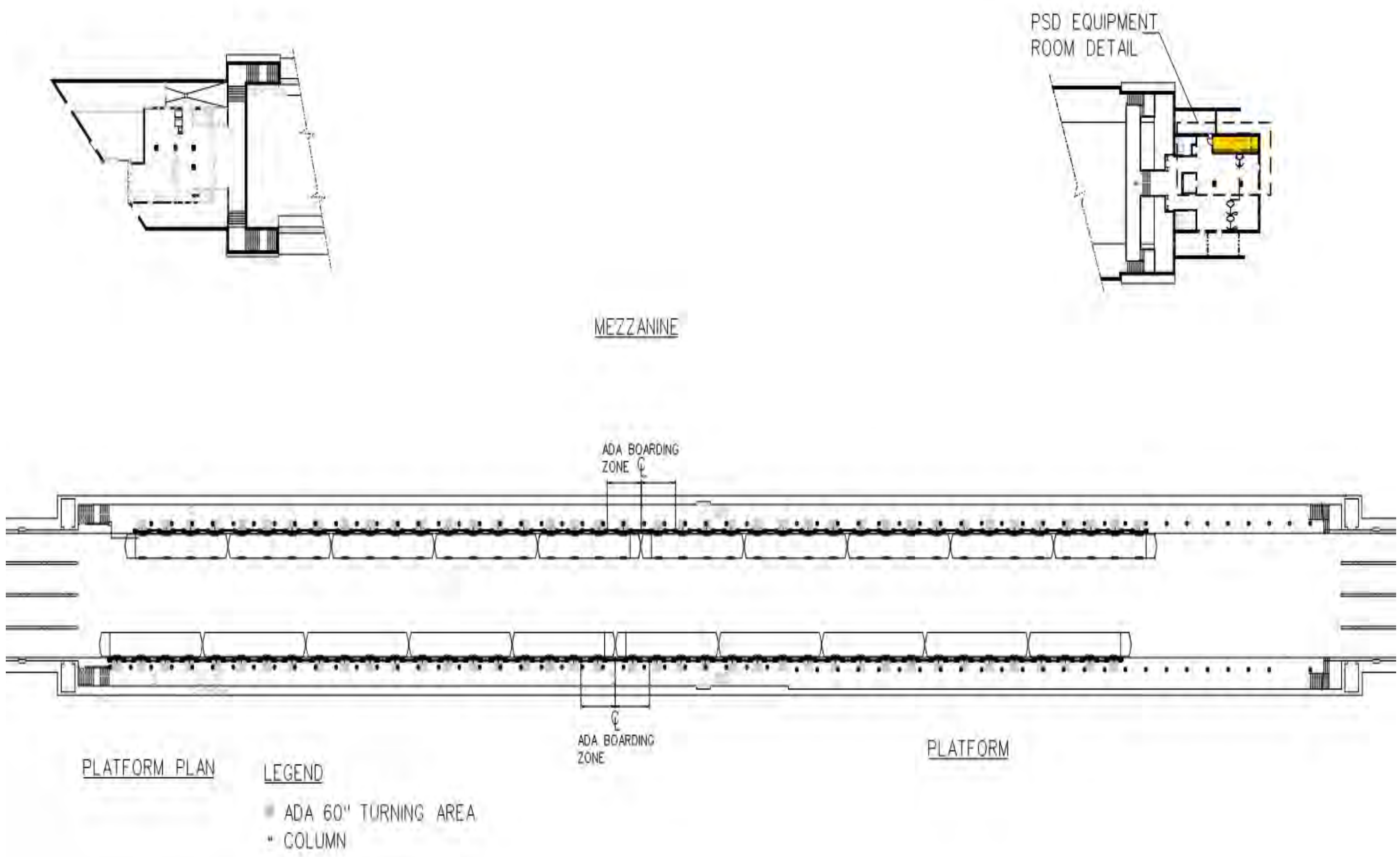

***Figure 1** – Overall Station Plan*
Bay Parkway Station

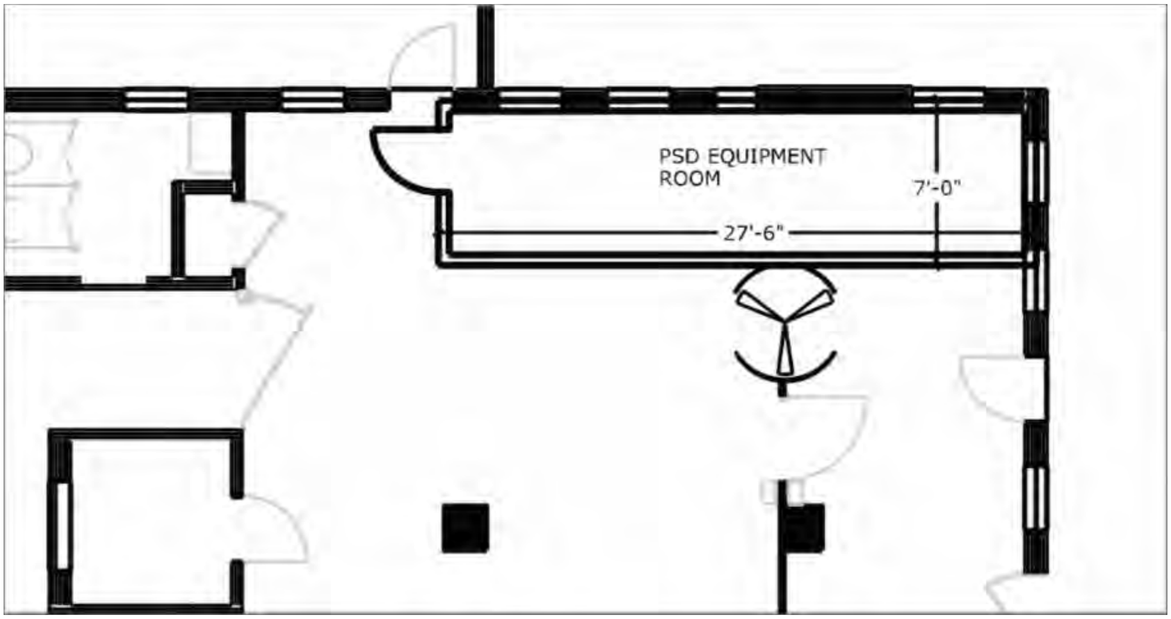

***Figure 2** – PSD Equipment Room 1 Detail*
Bay Parkway Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 & 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Bay Pkwy 22nd Avenue
Peak Demand Load from ConEd Report, (kW)	39.2
Apparent Power (kVA)	49.0
Station Peak Demand Load, Max Current, (A)	136.1
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	331
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	469
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 800A feeder. Station has (2) separate meter readings each for Normal & Reserve service. This analysis is for **Normal service**.

***Table 1**- Power Capacity Analysis – (Normal Service)*

Station
Power Capacity Analysis

Station Name	Bay Pkwy 22nd Avenue
Peak Demand Load from ConEd Report, (kW)	20.8
Apparent Power (kVA)	26.0
Station Peak Demand Load, Max Current, (A)	72.2
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	267
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	533
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 800A feeder. Station has (2) separate meter readings each for Normal & Reserve service. This analysis is for **Reserve service**.

***Table 2**- Power Capacity Analysis – (Reserve Service)*

Historic Restrictions:
None.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $32.6M to install APGs and $41.3M to install PSDs (See Appendix E).

Figure 3 *– Typical platform view*
Bay Parkway Station

1.43– MR 077 | Kings Hwy Station

Summary: *Kings Hwy Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

Kings Hwy Station is an open cut station with two side platforms. The platform structures are cast-in-place concrete. The width of the southbound platform is approximately 12'-0" throughout. Columns are spaced 11'-10" on center with column faces 3'-0" away from the platform edge. Due to the extremely limited width of the existing platforms, an equipment room would not fit on either platform (see Figure 2). The mezzanines are likewise extremely limited in size, and therefore cannot serve as a location for the equipment room. See figure 1 below. (Note: the southbound platform was not surveyed due to ongoing construction)

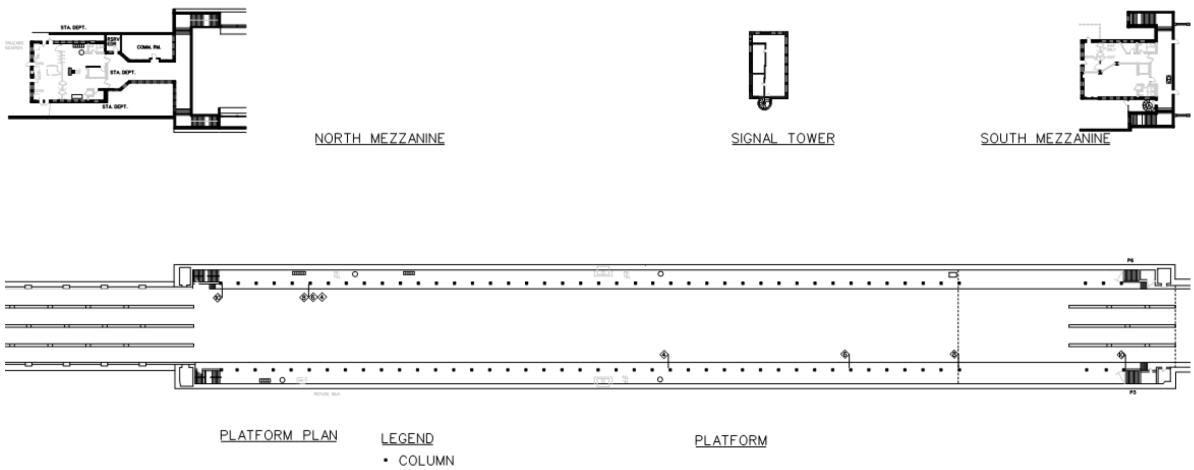

Figure 1 – *Congested/Narrow Station Plan*
Kings Hwy Station

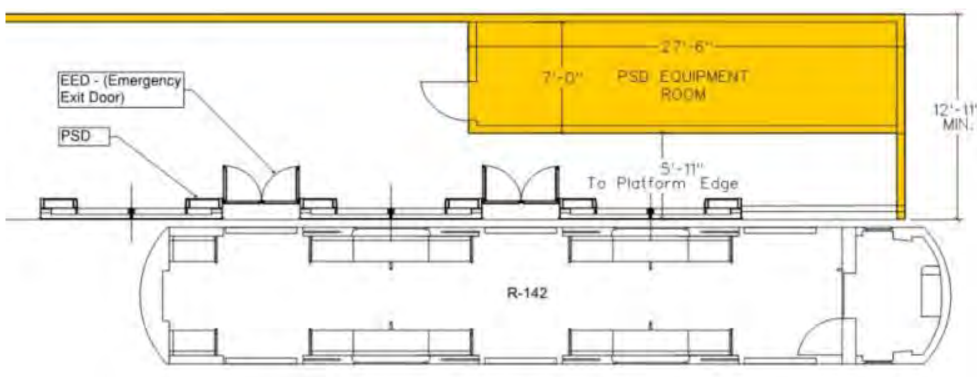

Figure 2 – *Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimensions)

1.44 – MR 078 | Avenue U Station

Summary: *Avenue U Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Avenue U Station is open cut with two side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. The platform columns are spaced 12'-0" on center, and column faces typically measure 3'-0" from the platform edge. The standard platform width is 12'-0" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

Since there are 2 platform edges at this station, 1 full size equipment rooms would be required. The equipment room could be located at the north mezzanine. (**Figure 1 & Figure 2).** The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

This platform edge was re-constructed within the last five years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system.

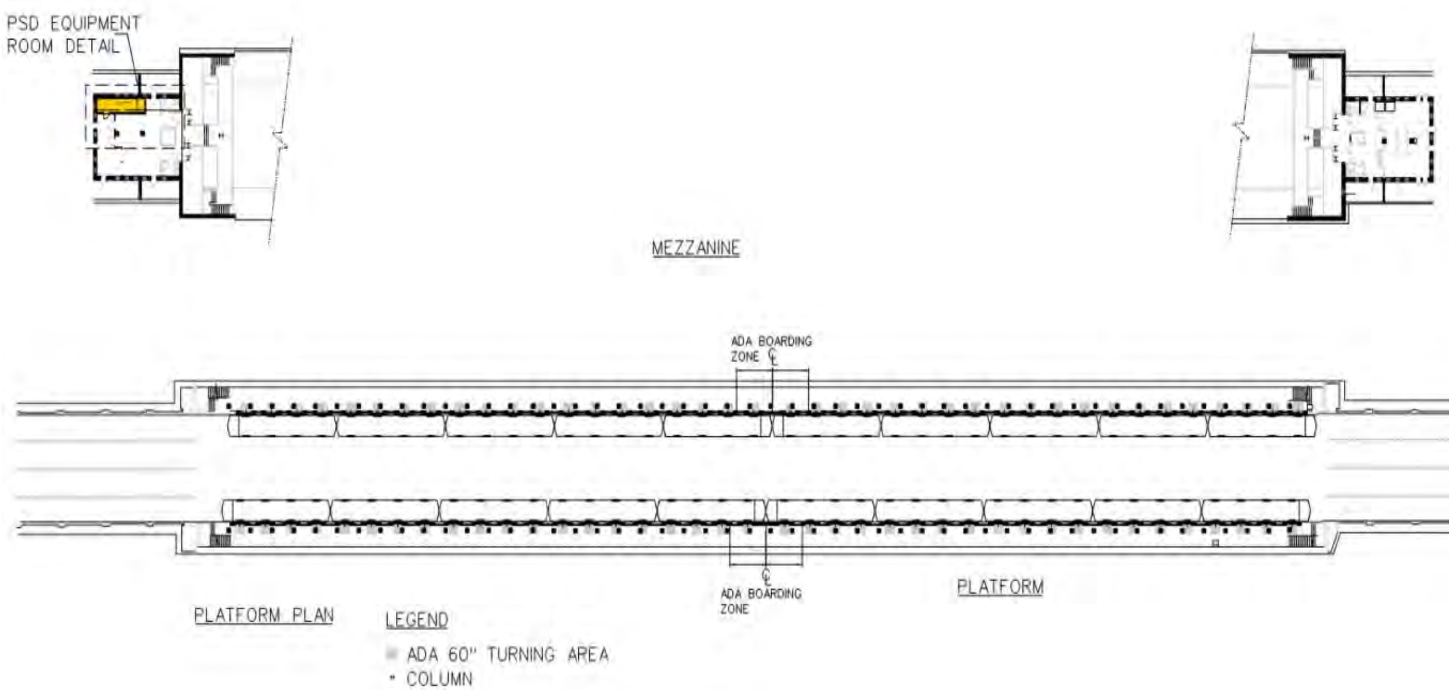

Figure 1 *– Overall Station Plan*
Avenue U Station

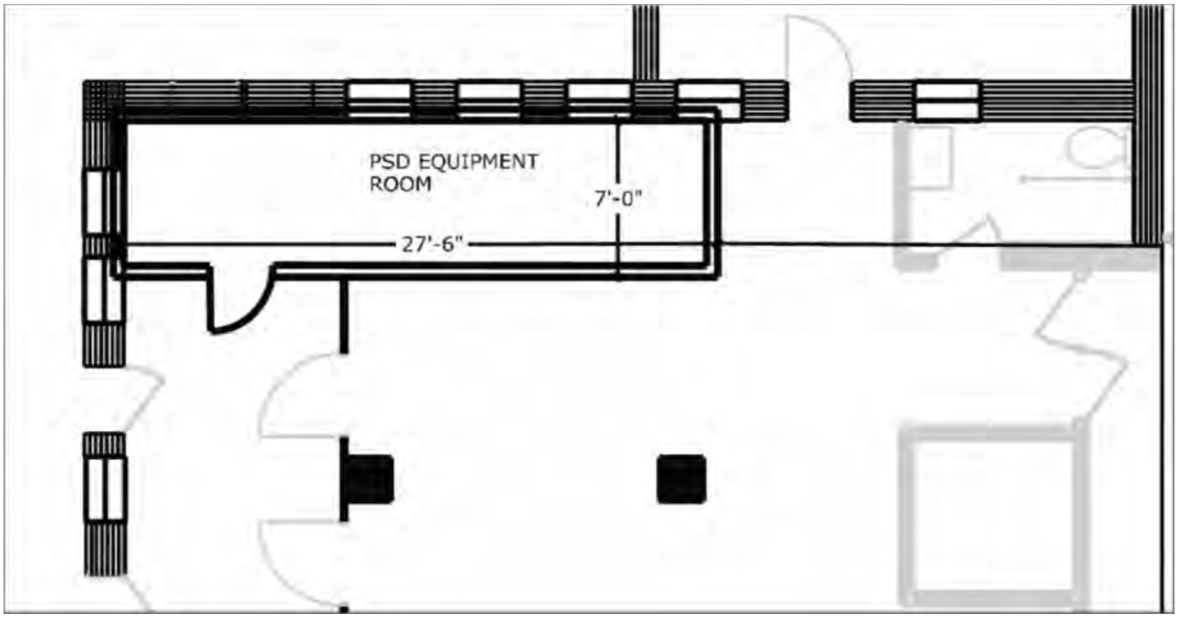

Figure 2 *– PSD Equipment Room 1 Detail*
Avenue U Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 & 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Avenue U
Peak Demand Load from ConEd Report, (kW)	25.6
Apparent Power (kVA)	32.0
Station Peak Demand Load, Max Current, (A)	88.9
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	283
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	517
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 800A fuses at Service switch. Station has (2) separate meter readings each for Normal & Reserve service. This analysis is for **Normal service**.

Table 1*- Power Capacity Analysis (Normal Service)*

Station
Power Capacity Analysis

NYCT Station MR Number	78
Station Name	Avenue U
Peak Demand Load from ConEd Report, (kW)	0.6
Apparent Power (kVA)	0.8
Station Peak Demand Load, Max Current, (A)	2.1
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	196.7
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	603
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 800A fuses at Service switch. Station has (2) separate meter readings each for Normal & Reserve service. This analysis is for **Reserve service**. The meter # for reserve service should be # 9360801

Table 2*- Power Capacity Analysis (Reserve Service)*

Historic Restrictions:
The Avenue U station is a historically designated property. As such, design will require review by the New York State Historical Preservation Office.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $30.9M to install APGs and $38.4M to install PSDs (See Appendix E).

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Figure 3 *– Typical platform view*
Avenue U Station

1.45 – MR 079 | 86th Street Station

Summary: *86th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 21" (see figure 1).*

Description

The 86th Street Station is an open cut station with two side platforms. The platform structures are cast-in-place concrete. The width of the platform is approximately 12'-2" throughout. There is one staircase along the northbound platform which would constrain wheelchair movement with PSDs installed. Columns are spaced 7'-3" on center with column faces 3'-0" away from all platform edges. The implementation of a platform edge barrier would reduce this width to 21" or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. **(see Figure 1)**.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Non-Compliant ADA condition*
86th Street Station

1.46 – MR 461 | Queensboro Plaza Station

Summary: *Queensboro Plaza Station is feasible for APGs only. The "7", "N" and "W" trains are served on both the upper & lower levels, with the 7 train and N/W trains on opposite sides of the center / island platforms. The No. 7 sides of these platforms are the subject of a separate station report. Full height PSDs are infeasible due to low beams above the platform edge at the upper level platform. Platform edge reconstruction will be required to support an APG system (see Appendix B). Existing power is adequate.*

Description

Queensboro Plaza Station is elevated with two straight center / island platforms stacked on top of each other. See figure 1 for an overall station plan. Both platforms are made of cast-in-place concrete. On the southbound platform, columns are spaced 48' on center with column faces 4'-8" from the platform edge. On the lower platform, columns are spaced 24' on center with column faces 2'-2" from the platform edge. Both platforms are approximately 19'-6" wide. On the lower platform, there is a vertical clearance of approximately 8'-0", which reduces to 7'-2" at the east-end of the platform. On the upper platform, there is a vertical clearance of approximately 7'-2" to canopy beams at the platform edge.

Full Height PSDs: Full height PSDs are infeasible due to the low beams of the canopy at the upper level platform. The bottom of the existing beams are at 7'-10", whereas PSD manufacturers require 8'-6" of height.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, entrapment prevention sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be CCTV cameras over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Wall mounted conduits below the upper and lower platform edge would need to be relocated to accommodate the requirements of the APG system. Minimal overhead structure would be needed to accommodate cameras and sensors in the small portion of the platforms not covered by canopies

Equipment Room

One room can be accommodated at the eastern end of the upper platform. The proposed room would measure approximately 27' x 7'-6" (see figure 2). As there are four platform edges at this station (including the No. 7 train – covered in a separate report), two equipment rooms would be needed to accommodate all of the required equipment. An additional room can be located in a similar location on the lower platform.

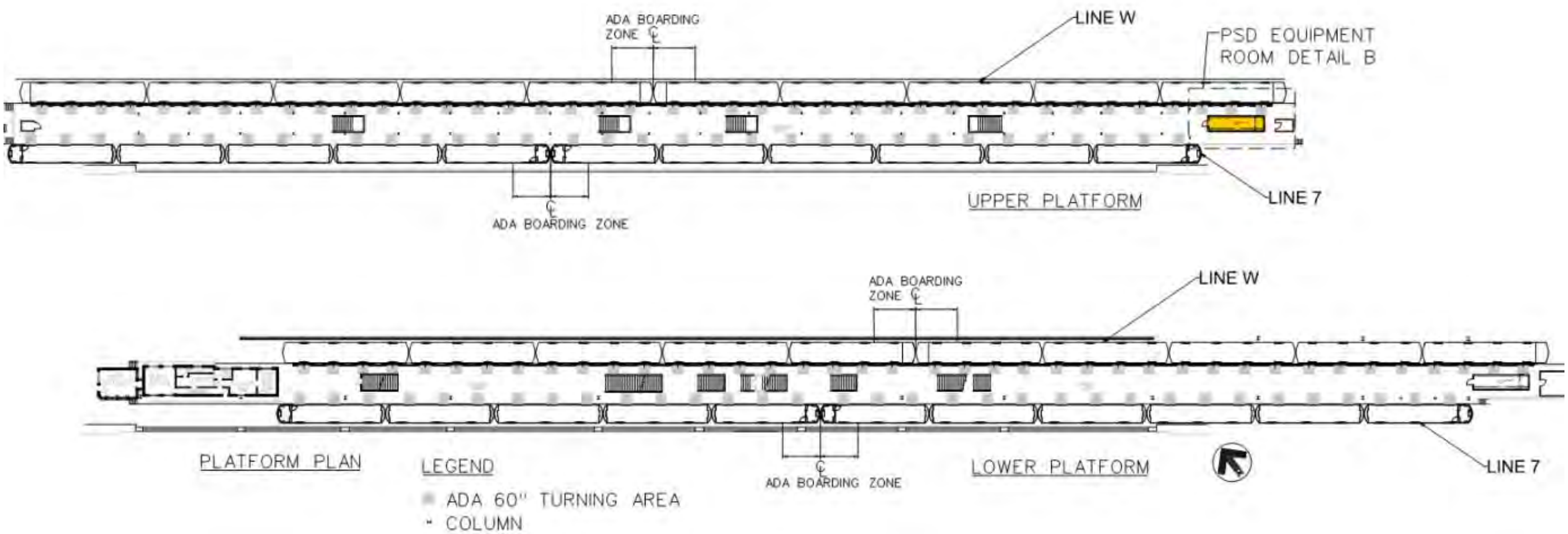


***Figure 1** – Platform plans*
Queensboro Plaza Station

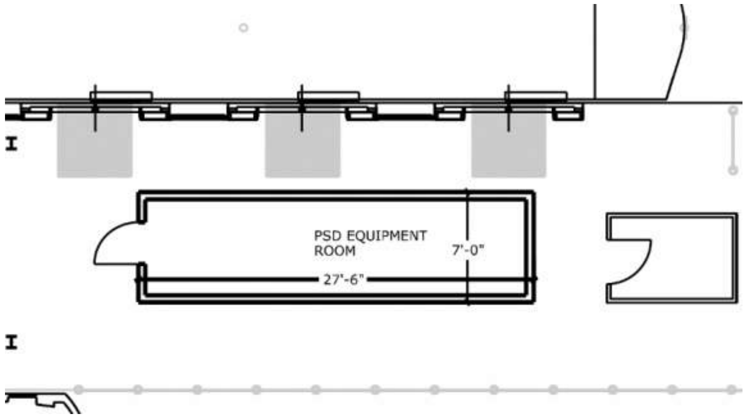


***Figure 1** – Equipment Room detail*
Queensboro Plaza Station

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

The platform edges were reconstructed within the last thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 2.6. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

Platform obstructions within 5' of edge:

- Southbound (lower) platform: All columns are 26" from the Hudson Yards platform edge.
- Northbound (upper) platform: All columns are 51" from the platform edge.

These obstructions do not present an impediment to the installation of APGs.

Lighting:

Existing lighting: There are Linear fluorescent fixtures mounted approximately 1' from platform edge for southbound and centered under canopy on the northbound platform. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate electrical capacity (only from the Normal service) to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	Queensboro Plaza
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	118.4
Apparent Power (kVA)	148.0
Station Peak Demand Load, Max Current, (A)	411.1
Maximum Amount of Doors	146.0
PSD Total Load Including All Miscellaneous Loads, (A)	315.0
Total Load (Station Peak + PSD), (A)	726
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	74
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. This analysis is for **Normal service**. Total doors: 146. {'W'-80 + '7'-66}

***Table1**- Power Capacity Analysis (Normal Service)*

Station Power Capacity Analysis

Station Name	Queensboro Plaza
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	163.2
Apparent Power (kVA)	204.0
Station Peak Demand Load, Max Current, (A)	566.7
Maximum Amount of Doors	146.0
PSD Total Load Including All Miscellaneous Loads, (A)	315.3
Total Load (Station Peak + PSD), (A)	882
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	0
Is Electrical Service Adequate?	**No**
Notes	Service rating is based on the 1 line diagram, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. This analysis is for Reserve **service**. Total doors: 146. {'W'-80 + '7'-66}

***Table 2**- Power Capacity Analysis (Reserve Service)*

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $33.1M to install APGs (See Appendix E).

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*
>
> a. *Column location in relation to the platform edge*
> b. *Platform edge clearance adjacent to stairs and other impediments*
> c. *Impacts to ADA path of travel and boarding areas*
> d. *Conflicts of PSD/APG/RPSDs with Signals cables*
> e. *Sufficient platform width*
> f. *Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*
>
> a. *Structural capacity of platforms to accept PSD/APG/RPSDs*
> b. *Feasibility & location for PSD/APG/RPSDs equipment room*
> c. *Confirmation of adequate power for PSD/APG/RPSDs*
> d. *Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> e. *Determination of communications requirements, availability and cost*
> f. *Determination of gap detection and entrapment avoidance technology requirements*
> g. *Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
    - Double the amount of motors as PSDs (each motor operating a single leaf).
    - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
    - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
    - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY. Status of doors will be provided to crew via indicator lights, with no automated propulsion cutout.

If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

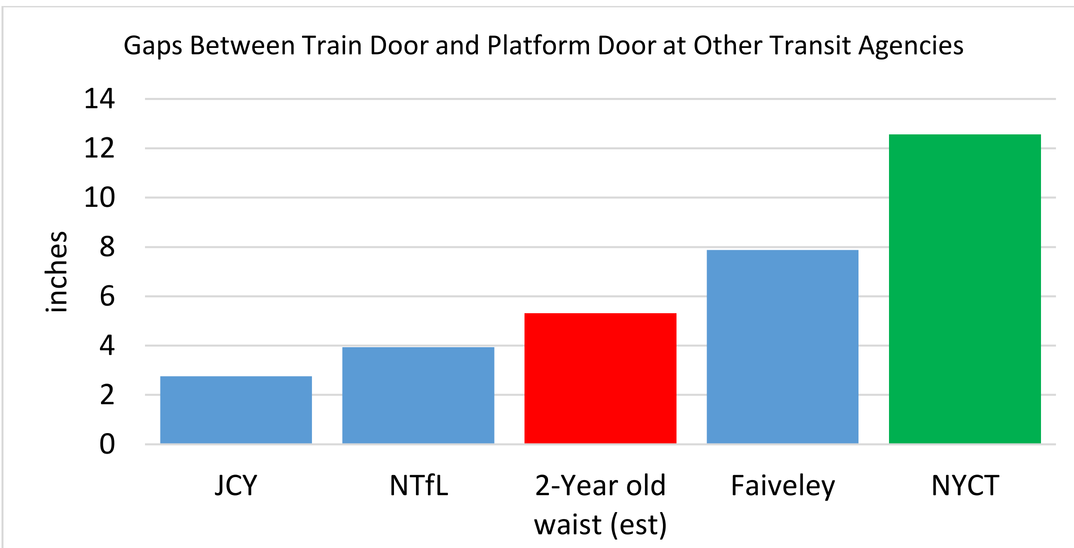


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

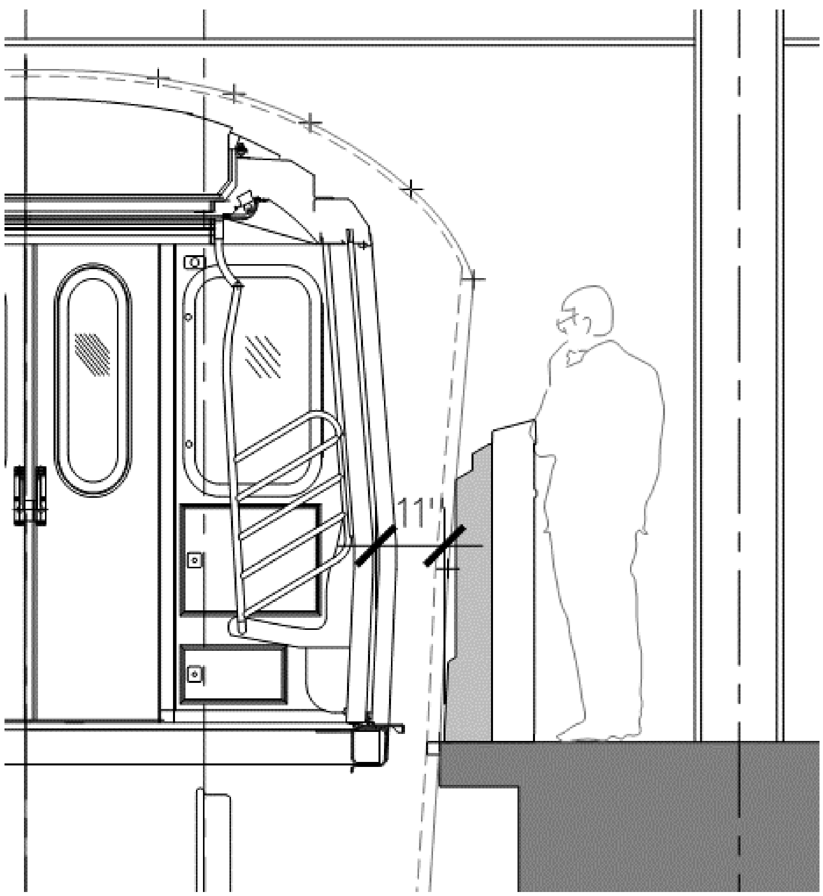


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber “bumpers” on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6” into the line equipment envelope. This would leave a 5” gap between the platform and car doors allowing approximately 2” of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5” by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor’s window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor’s window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **<u>bold/underline</u>**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	PSD System 1	PSD System 2	PSD System 3
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are "existing" as defined by code. All the rolling stock is also to be considered "existing" under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60" radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36" of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

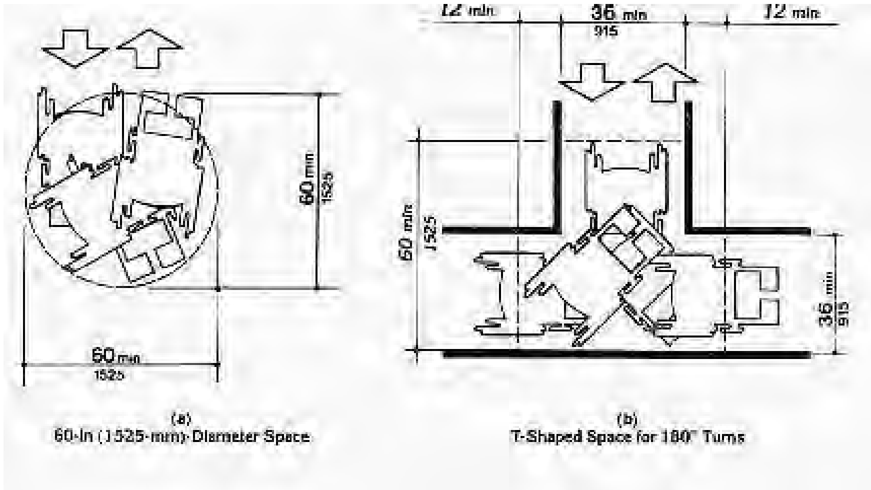
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

> *Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.*

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36” which may be constricted to 32” at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

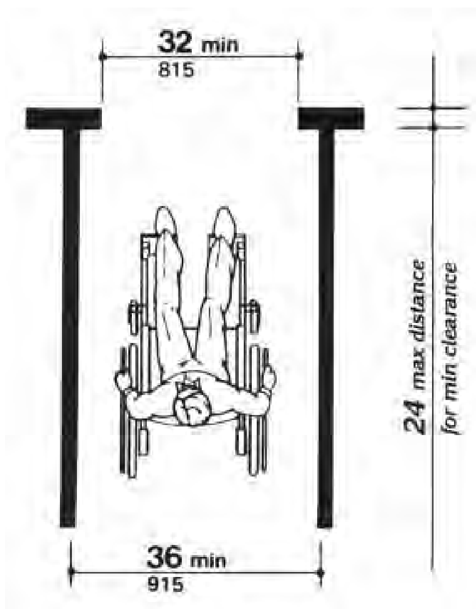


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

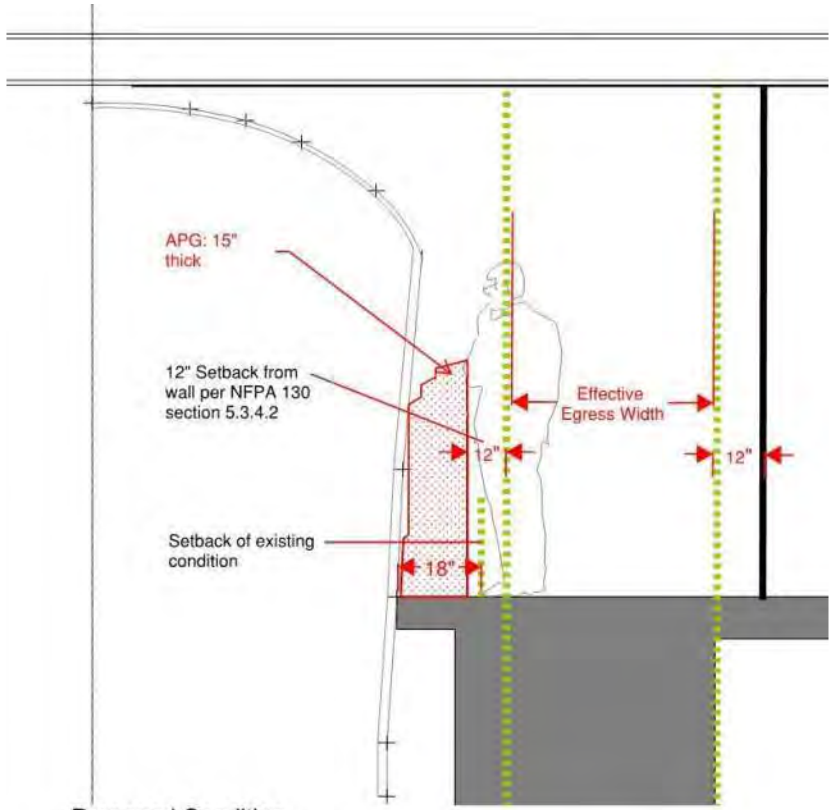
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15” of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

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Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

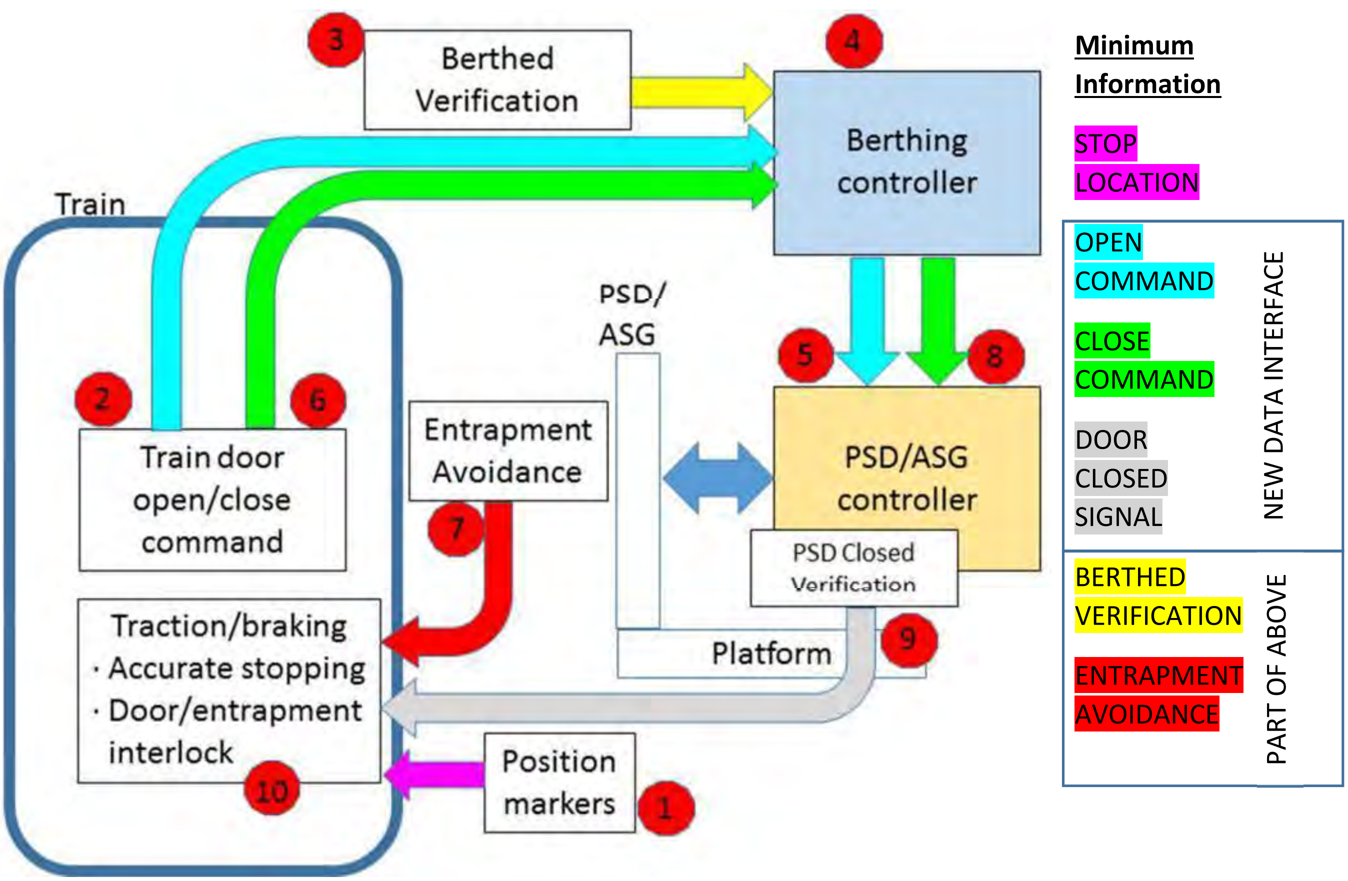
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



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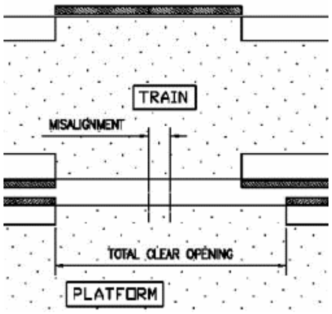
Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5" clear opening, a design for NY should meet the ADA Accessibility Guideline of 36".

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a 'distance totem' which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy's COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

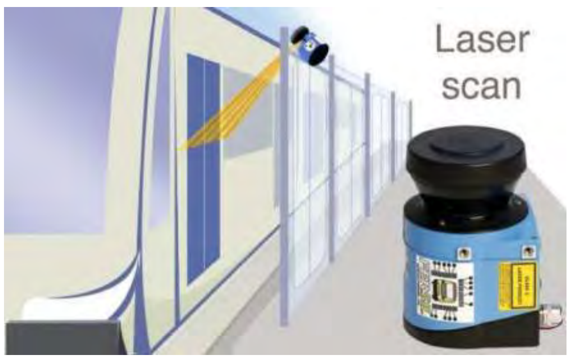
Dedicated Loop

The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically



If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.

For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

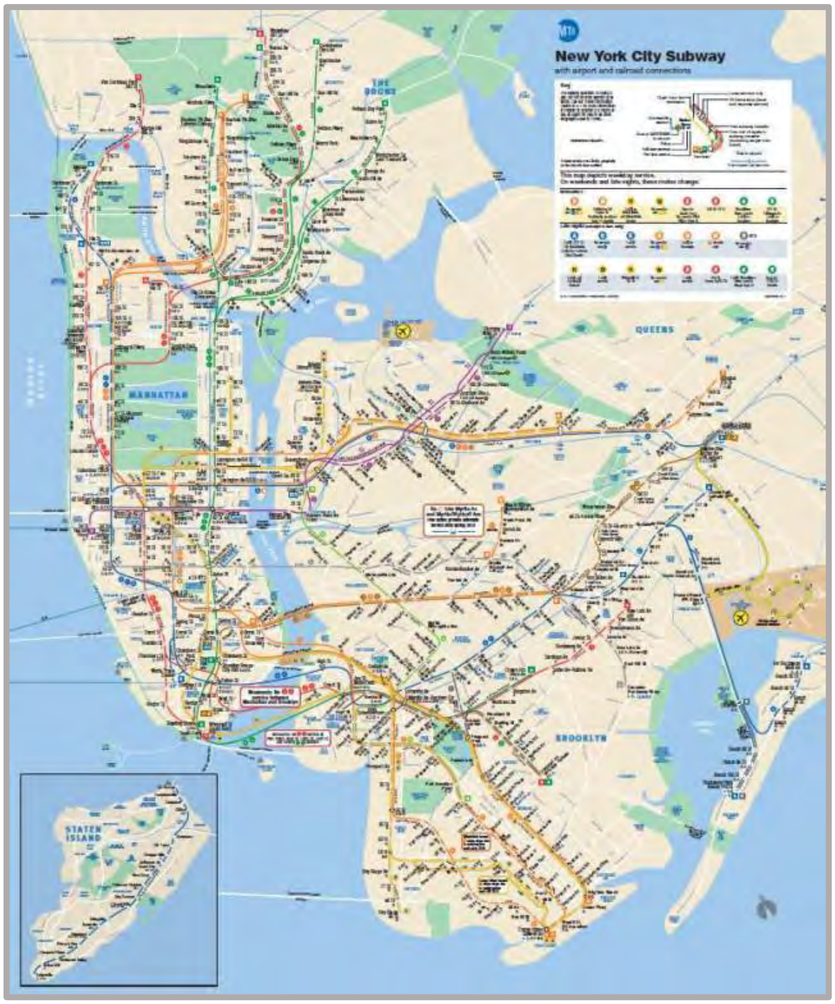


Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4'-0"). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

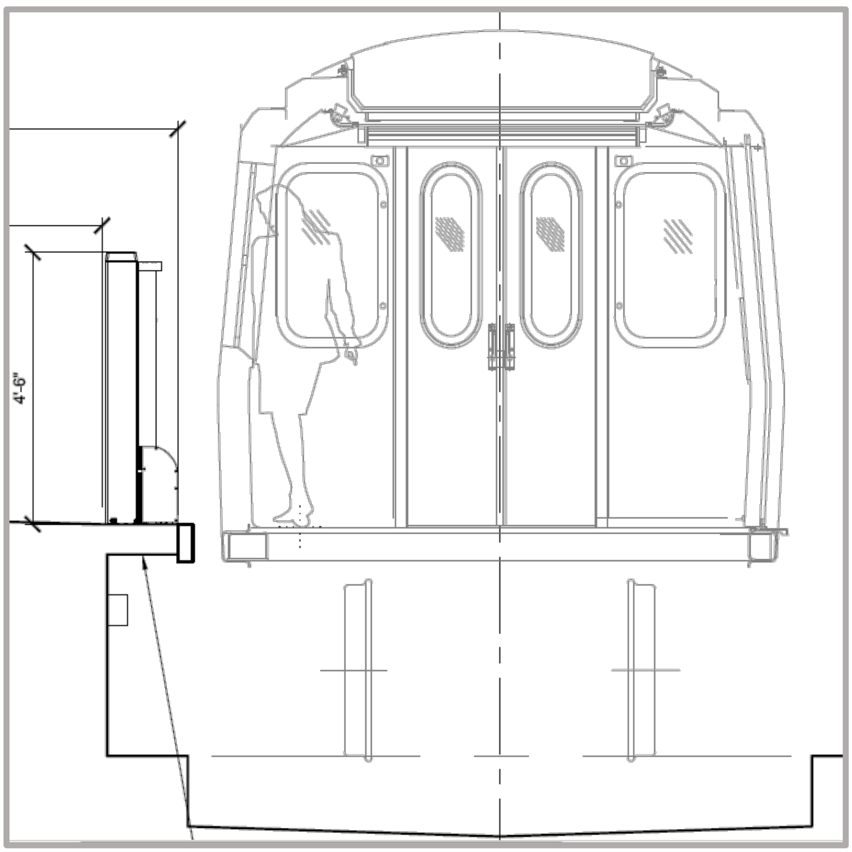


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

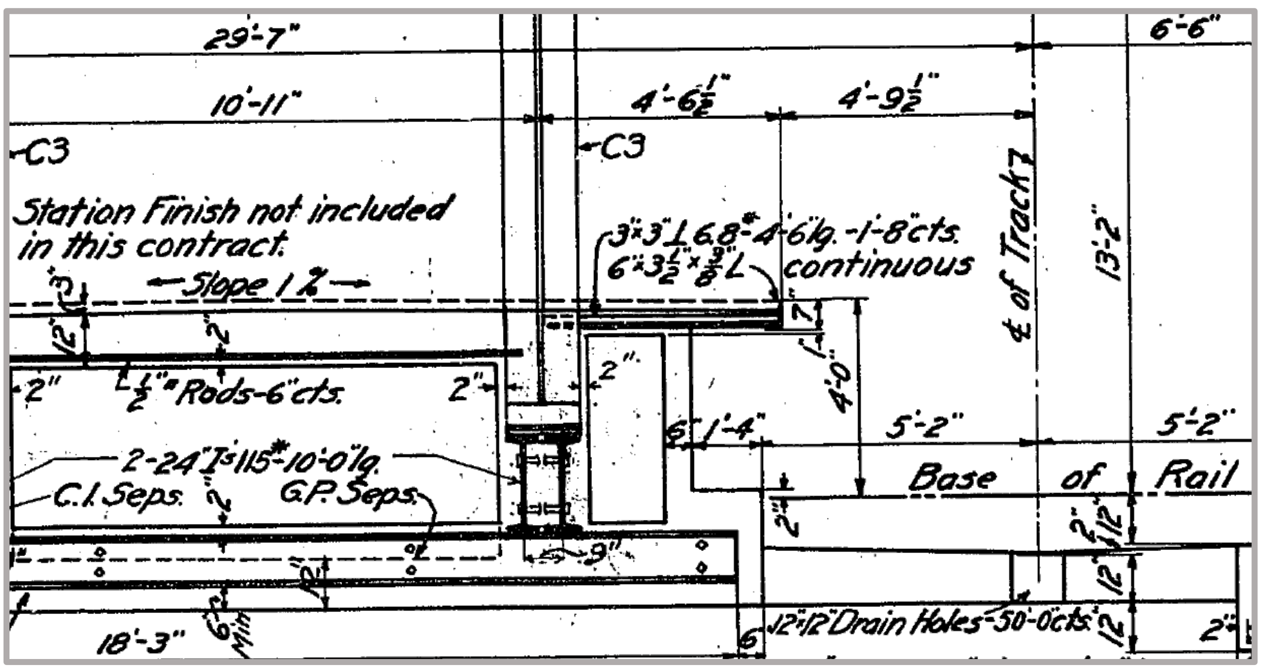


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

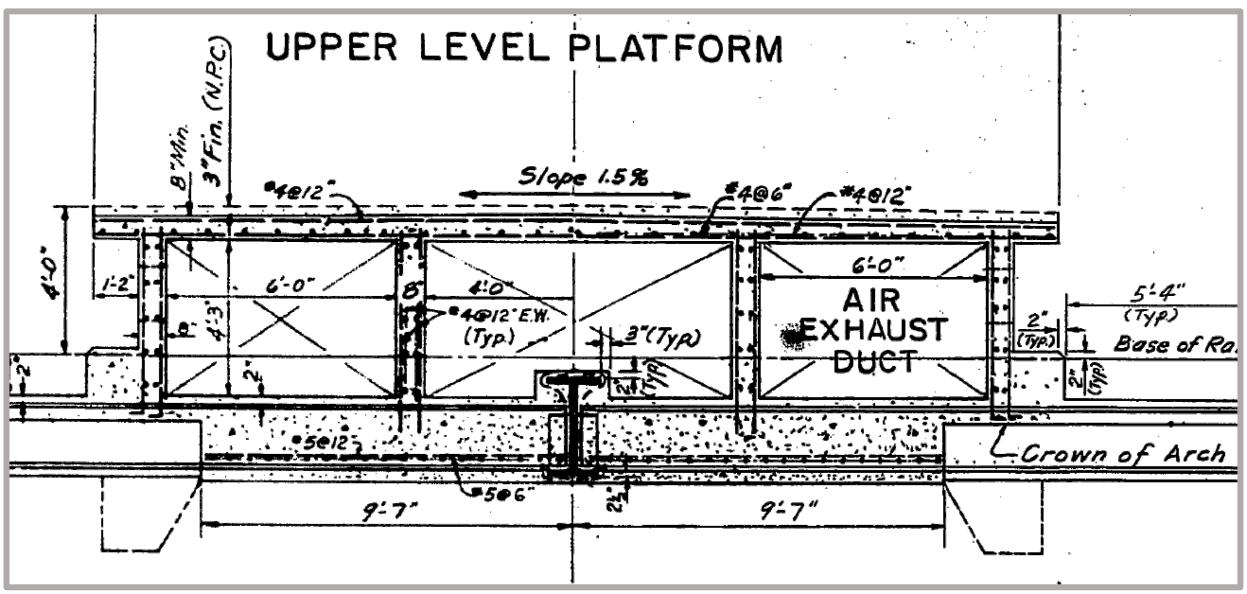


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

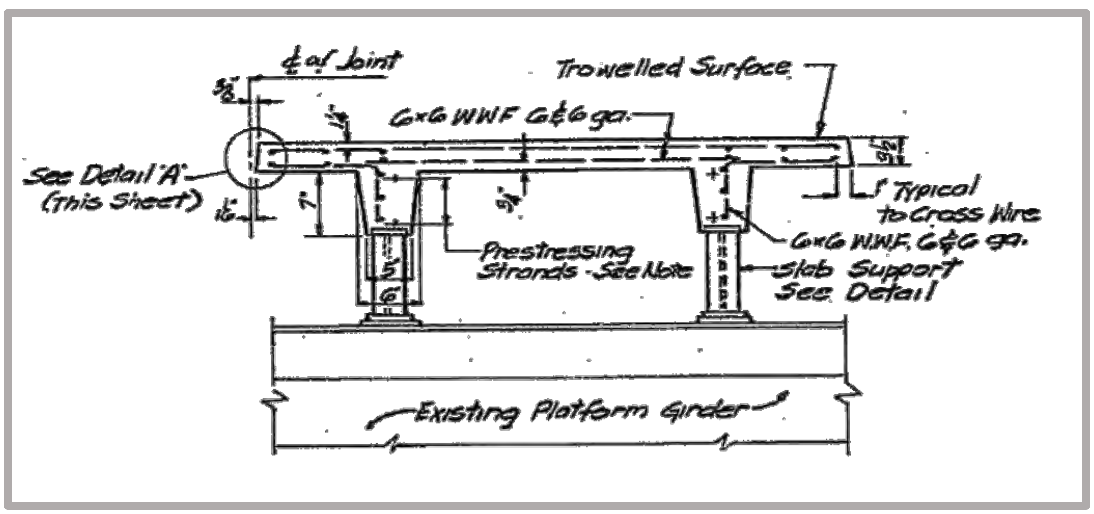


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

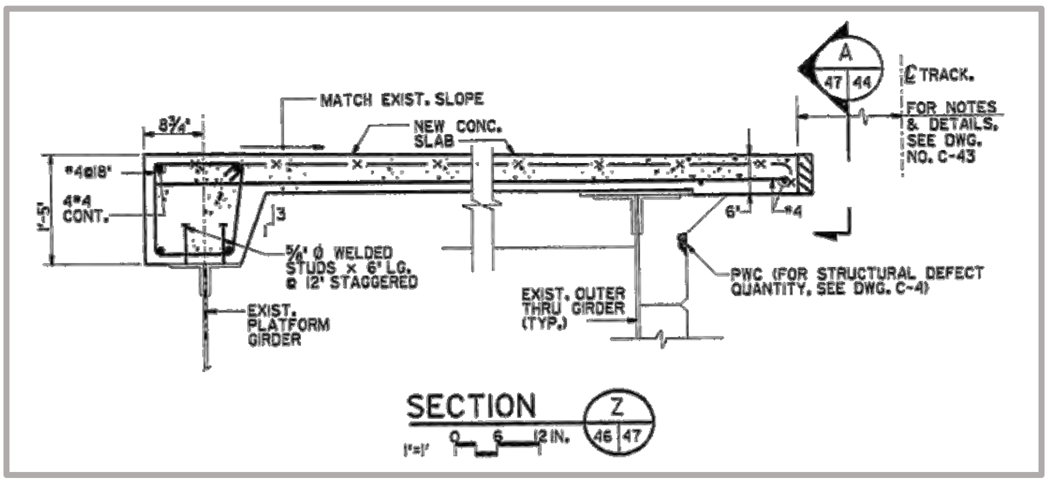


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2'-9"), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

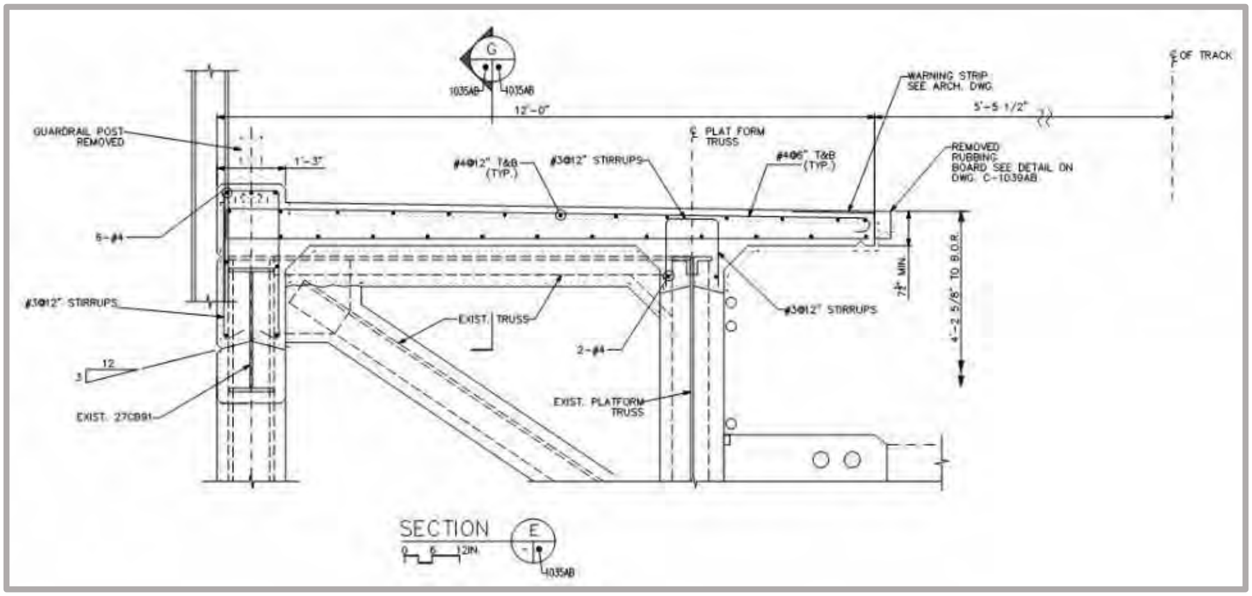


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3" thick structural slab with an approximately 3" thick topping slab. If the topping slab is fully removed, a 6" thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6" thick slab will be sufficient for a cantilever length of up to approximately 3'-0", greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6" structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6" minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

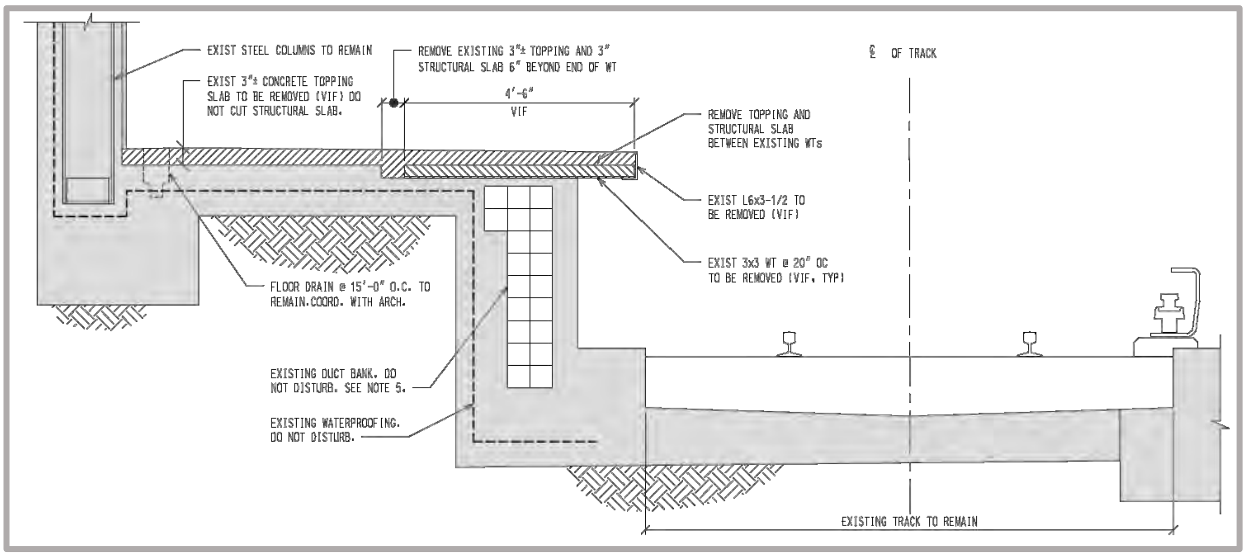


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

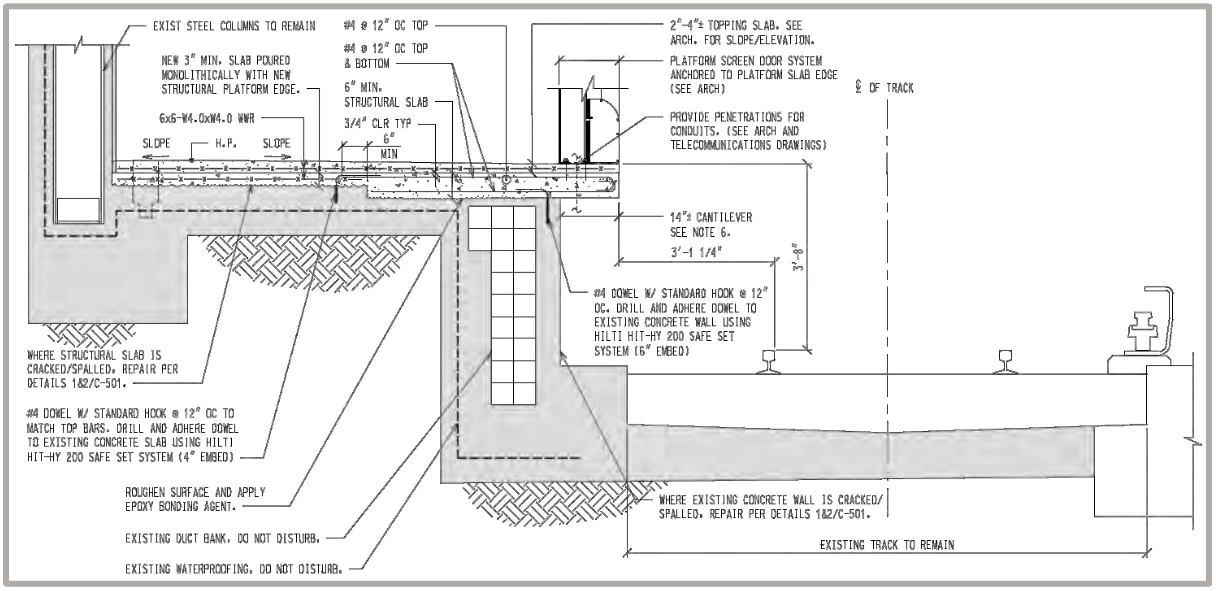


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

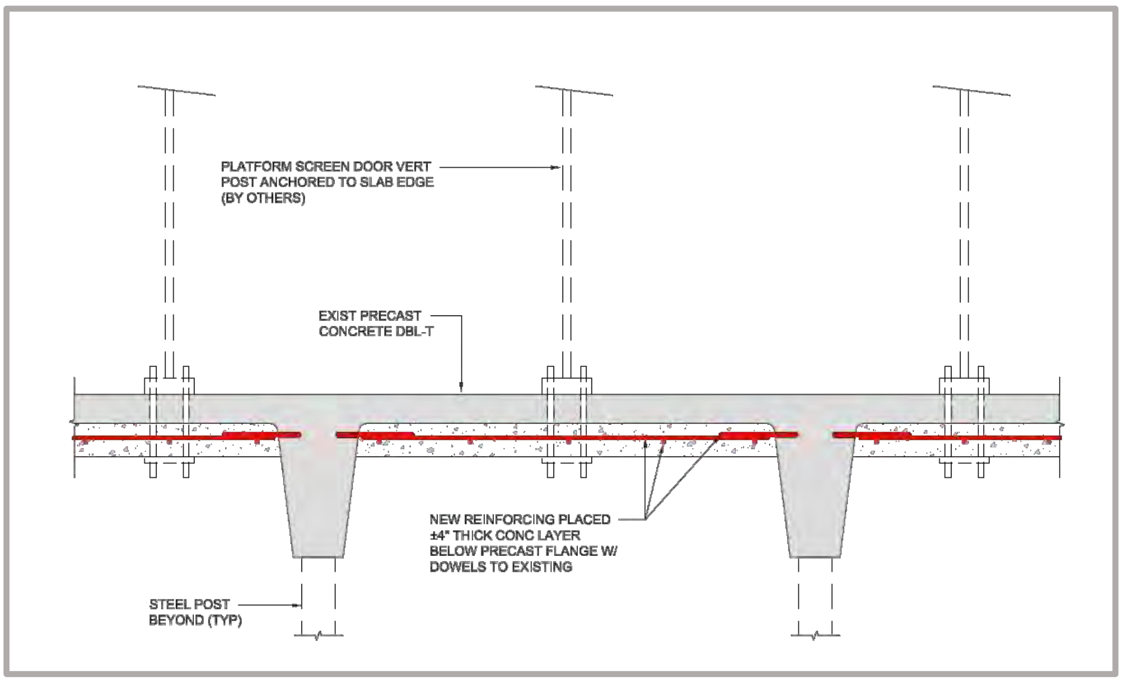


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5' – 11" of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis

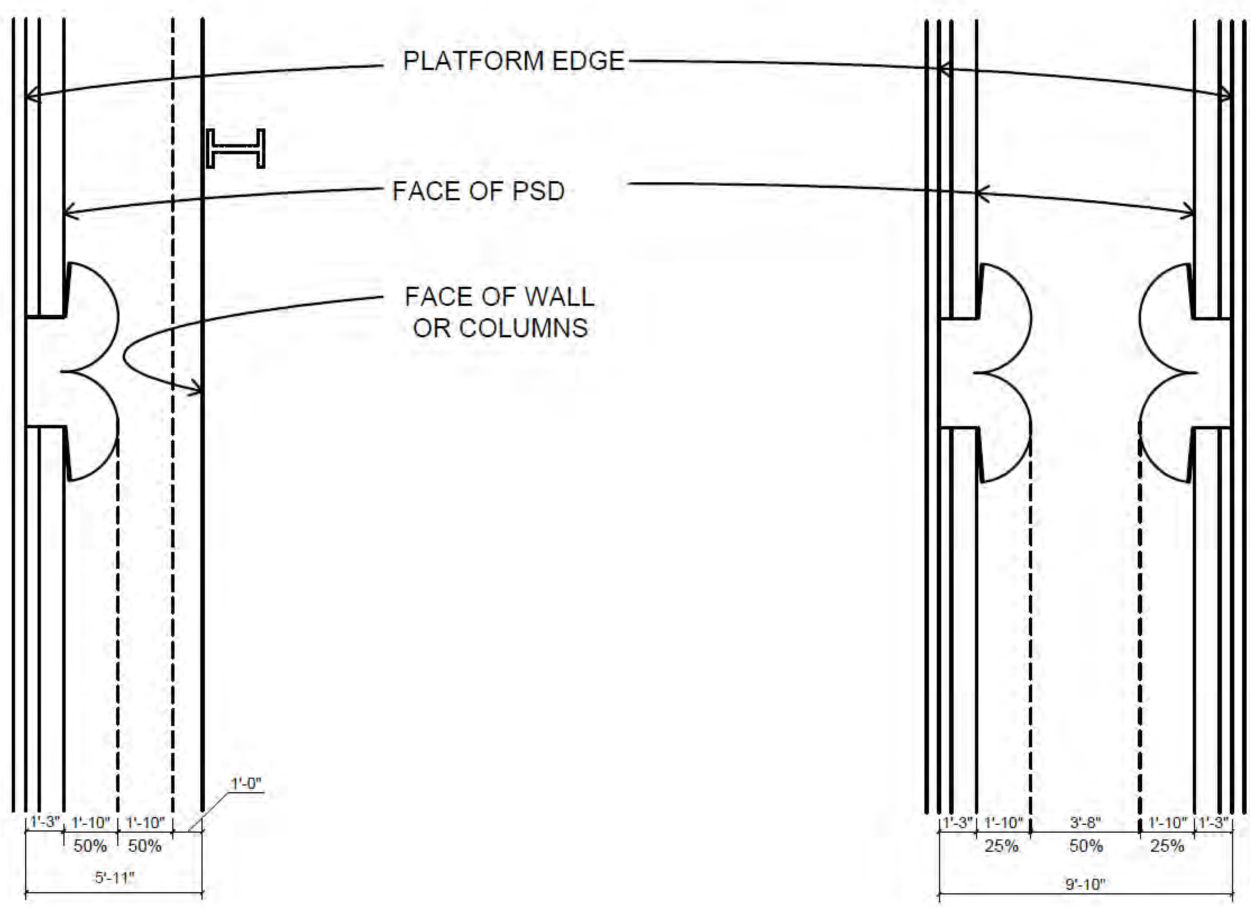


FIGURE 1: SIDE PLATFORM

FIGURE 2: CENTER PLATFORM

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

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MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	9	$ 63,500 per month [Year 01]	$ 571,500		
		12	$ 83,590 per month [Year 02]	$ 1,003,080		
		12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment.	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
		12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663

	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663

7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *	
		Year 3	$ 257 per hour *	
	Optional :	Year 4	$ 268 per hour *	
	Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

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ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations
ESTIMATE DATE:	January 7, 2019

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VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

MTA/NYCT

January 7, 2019

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.2 *APGs / PSDs will provide 39 emergency egress doors with push bars per platform*
1.3 *Each platform edge will have 50 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 It is assumed that each train has 10 cars on this line
2.2 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.3 In respect of the PSD option, only platforms that have not been upgraded in the recent past will require platform edge replacement.
2.4 There are no special security requirements made necessary by installation of the APG system
2.5 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.6 This estimate does not provide for the replacement of Platform Edge Lighting
2.7 Premium cost for night time work is considered 50% of total labor cost

3.0 ***Exclusions - Costs not included in the estimate:***

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VJ ASSOCIATES
ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

MTA/NYCT

January 7, 2019

BASIS OF ESTIMATE

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems
3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length
3.4 Costs associated with NYCT State Of Good Repair improvements to the station
3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.
3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs
3.7 Escalation Cost is not included; Anticipate at 5% per annum.
3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.
3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium
3.10 NYCT project cost is not included
3.11 GO and flagging cost is not included
3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or "soft" costs:***

4.1 Design and Construction Contingency
4.2 Contractor O & P
4.3 Insurance
4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 Given the limited time available, no drawings were developed to support this estimate.

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MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

January 7, 2019

	ORDER OF MAGNITUDE COSTS		MRN 026	MRN 027	MRN 071	MRN 072	MRN 076	MRN 078	MRN 058	MRN 461	MRN 008	MRN 010
	DESCRIPTION		DEKALB AVENUE FLATBUSH AVE	ATLANTIC AVE. BARCLAYS CTR.	8TH AVE.	FORT HAMILTON PKWY	BAY PKWY	AVENUE U	CONEY ISLAND	QUEENSBORO PLAZA	5TH AVE./59TH ST.	49TH STREET
1	AUTOMATIC PLATFORM GATES (APG'S)		$17,077,899	$16,629,898	$16,610,102	$16,803,086	$17,283,586	$16,401,437	$16,451,775	$17,522,627	$16,516,828	$17,737,576
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$17,077,899	$16,629,898	$16,610,102	$16,803,086	$17,283,586	$16,401,437	$16,451,775	$17,522,627	$16,516,828	$17,737,576
4	GENERAL REQUIREMENTS	15.00%	$2,561,685	$2,494,485	$2,491,515	$2,520,463	$2,592,538	$2,460,216	$2,467,766	$2,628,394	$2,477,524	$2,660,636
	SUB-TOTAL:		$19,639,584	$19,124,382	$19,101,617	$19,323,548	$19,876,124	$18,861,652	$18,919,541	$20,151,021	$18,994,352	$20,398,212
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,909,896	$4,781,096	$4,775,404	$4,830,887	$4,969,031	$4,715,413	$4,729,885	$5,037,755	$4,748,588	$5,099,553
	SUB-TOTAL:		$24,549,480	$23,905,478	$23,877,021	$24,154,436	$24,845,155	$23,577,066	$23,649,426	$25,188,777	$23,742,940	$25,497,765
6	OVERHEAD & PROFIT	15.00%	$3,682,422	$3,585,822	$3,581,553	$3,623,165	$3,726,773	$3,536,560	$3,547,414	$3,778,316	$3,561,441	$3,824,665
	SUB-TOTAL:		$28,231,902	$27,491,300	$27,458,575	$27,777,601	$28,571,929	$27,113,625	$27,196,840	$28,967,093	$27,304,381	$29,322,430
7	BONDS & INSURANCE	3.75%	$1,058,696	$1,030,924	$1,029,697	$1,041,660	$1,071,447	$1,016,761	$1,019,882	$1,086,266	$1,023,914	$1,099,591
	SUB-TOTAL:		$29,290,598	$28,522,223	$28,488,271	$28,819,261	$29,643,376	$28,130,386	$28,216,722	$30,053,359	$28,328,295	$30,422,021
	SUB-TOTAL:		$29,290,598	$28,522,223	$28,488,271	$28,819,261	$29,643,376	$28,130,386	$28,216,722	$30,053,359	$28,328,295	$30,422,021
	SUBTOTAL CONSTRUCTION COST W/O ACM		**$29,290,598**	**$28,522,223**	**$28,488,271**	**$28,819,261**	**$29,643,376**	**$28,130,386**	**$28,216,722**	**$30,053,359**	**$28,328,295**	**$30,422,021**
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		**$29,290,598**	**$28,522,223**	**$28,488,271**	**$28,819,261**	**$29,643,376**	**$28,130,386**	**$28,216,722**	**$30,053,359**	**$28,328,295**	**$30,422,021**
10	DESIGN CONSULTANT FEES	10.00%	$2,929,060	$2,852,222	$2,848,827	$2,881,926	$2,964,338	$2,813,039	$2,821,672	$3,005,336	$2,832,829	$3,042,202
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		**$32,219,658**	**$31,374,446**	**$31,337,098**	**$31,701,187**	**$32,607,714**	**$30,943,425**	**$31,038,394**	**$33,058,695**	**$31,161,124**	**$33,464,223**
	ADD ALTERNATIVES											
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		4,867,142	4,531,048	4,051,922	4,337,516	4,642,660	3,993,823	4,724,706	N/A	$4,697,318	$5,331,194
	Add for Markups (as above)	88.66%	4,315,349	4,017,358	3,592,551	3,845,767	4,116,317	3,541,039	4,189,061	N/A	4,164,778	4,726,791
	SUB-TOTAL PSD ALTERNATIVE		**$9,182,490**	**$8,548,406**	**$7,644,473**	**$8,183,284**	**$8,758,977**	**$7,534,862**	**$8,913,766**	**N/A**	**$8,862,097**	**$10,057,985**
	TOTAL PROJECT COST (PSD OPTION)		**$41,402,148**	**$39,922,852**	**$38,981,571**	**$39,884,471**	**$41,366,691**	**$38,478,287**	**$39,952,160**	**NA**	**$40,023,221**	**$43,522,208**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : DEKALB AVENUE FLATBUSH AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	679	LF		
5	LENGTH OF THE PLATFORM EDGE =	654	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,333**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,333	LF	7	9,331
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,665	SF	12	79,980
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	134	CY	2,500	335,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,335	EA	25	33,375
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,335	EA	25	33,375
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,333	LF	95	126,635
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,333	LF	15	19,995
26	Remove existing platform tiles	1,333	LF	12	15,996
27	Sawcut existing topping concrete at perimeter of removal area	1,333	LF	5	6,665
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,998	SF	8	63,984
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-0" wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,333	SF	15	19,995

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : DEKALB AVENUE FLATBUSH AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,714	SF	750	2,035,125
61	Spare Parts - Approx. 10% of Material Cost	1	LS	248,768	248,768
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : DEKALB AVENUE FLATBUSH AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,333	LF	60	79,980
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	700	LF	60	42,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	750	LF	60	45,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

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STATION : DEKALB AVENUE FLATBUSH AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,941,054	3,941,054
112					
113	TOTAL PSD WORK:				$ 17,077,899
115					
116	**ADD ALTERNATIVE**				
117					
118	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
119					
120	**ADD**				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,798	SF	750	4,348,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	459,022	459,022
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	88,386
129	L6x6x1/2 continuous angle	10	TONS	17,500	171,690
130	Drilling and bolting - 4 bolts at each connection	533	EA	216	115,171
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	80	HRS	162	12,960
137	Remove signal cables	600	LF	40	24,000
138	Remove conduit; Assuming 1"	600	LF	55	33,000
139	Install conduit in new position	600	LF	110	66,000
140	Install replacement cable; assumed single cable #12	600	LF	125	75,000
141	Re-commission / testing as required	2	EA	12,500	25,000
142	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
143	Premium Time	1,569	HRS	49	76,253
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : DEKALB AVENUE FLATBUSH AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,714)	SF	750	(2,035,125)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	248,768	(248,768)
152	Platform Edge Reconstruction work	(1)	LS	596,930	(596,930)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,333)	LF	30	(39,990)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,123,187	1,123,187
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				**$ 4,867,142**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : ATLANTIC AVE. BARCLAYS CTR.

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	618	LF		
5	LENGTH OF THE PLATFORM EDGE =	618	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,236**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,236	LF	7	8,652
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,180	SF	12	74,160
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,238	EA	25	30,950
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,238	EA	25	30,950
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,236	LF	95	117,420
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,236	LF	15	18,540
26	Remove existing platform tiles	1,236	LF	12	14,832
27	Sawcut existing topping concrete at perimeter of removal area	1,236	LF	5	6,180
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,416	SF	8	59,328
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-0" wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,236	SF	15	18,540

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : ATLANTIC AVE. BARCLAYS CTR.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Platform column restructuring**				
37	Demolition				
38	Install, maintain and remove temporary support	2	LS	15,000	30,000
39	Breakout existing platform slab for new column	2	LS	5,000	10,000
40	New Work				
41	Excavate for foundation for new column	2	EA	1,500	3,000
42	Foundation for new column	2	EA	5,000	10,000
43	New structural steel column	2	EA	20,000	40,000
44	Extend and repair beams above	2	LS	5,000	10,000
45	Grillage	2	EA	10,000	20,000
46					
47	**Equipment Room [7'-0" x 27'-6"]**				
48	Build off existing mezzanine slab		Note		
49	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
50	CMU Wall for equipment room	415	SF	45	18,675
51	Vertical connections with existing structure	20	LF	25	500
52	Roof for equipment room	193	SF	30	5,775
53	Fire rated door including frame & hardware	1	EA	2,500	2,500
54	Exterior wall finish				
55	Ceramic Tiling to match existing	415	SF	40	16,600
56	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
57	Concrete cove to match existing	42	LF	20	830
58	Interior Wall Finish - Paint	690	SF	5	3,450
59	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
60	Allow for 4" thick concrete pads for equipment	48	SF	20	963
61	Allowance for Mechanical Scope	1	LS	40,000	40,000
62	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
63	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
64	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
65					
66	**Automatic Platform Gates [APGs] - 4'-6" High**				
67	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
68	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
69	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
70	Platform End Gates (PEGs)	4	EA	13,000	52,000
71	Fixed Panels including framing and support; 4'-6" High	2,277	SF	750	1,707,750
72	Spare Parts - Approx. 10% of Material Cost	1	LS	229,125	229,125

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : ATLANTIC AVE. BARCLAYS CTR.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
73	Testing and commissioning	800	HRS	160	127,944
74	Product Warranty	1	LS	1,000,000	1,000,000
75	Allowance for Braille Signage	80	EA	2,500	200,000
76					
77	**Electrical**				
78	Electrical Upgrades				
79	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
80	Power and Lighting				
81	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
82	Allow for conduit / cable runs for power and communications under platform edge	1,236	LF	60	74,160
83	PSD Connections	1	LS	75,000	75,000
84	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
85	Power to PSD Room from EDR [Conduit & Cable]	200	LF	60	12,000
86	Reserve power to PSD Room from EDR [Conduit & Cable]	250	LF	60	15,000
87	No allowance for new lighting as if APG's are used		Note		EXCL.
88	Grounding				
89	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
90	MISC				
91	Testing and commissioning	1	EA	30,000	30,000
92	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
93					
94	**Communications**				
95	FA System				
96	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
97	CCTV coverage				
98	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
99	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
100	Berthing Technology Sensors				
101	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
102	Train Door Detection System				
103	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
104	Entrapment concerns				
105	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
106	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
107	Engineering and Testing	1,000	Hrs	160	159,930
108	Centralized monitoring/control				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : ATLANTIC AVE. BARCLAYS CTR.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
109	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
110	MISC				
111	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
112	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
113	Site Survey and Inspections	1	LS	100,000	100,000
114	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
115	Furnish Test Equipment allowance	1	LS	500,000	500,000
116	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
117					
118	Training				
119	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
120					
121	Out of hours Work				
122	Allow loss of production to work at night say 50%	1	LS	3,837,669	3,837,669
123					
124	TOTAL PSD WORK:				$ 16,629,898
126					
127	ADD ALTERNATIVE				
128					
129	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
130					
131	ADD				
132	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
133	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
134	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
135	Platform End Gates (PEGs)	4	EA	18,000	72,000
136	Fixed Panels including framing and support; Assuming 8'-0" high	5,022	SF	750	3,766,365
137	Spare Parts - Approx. 10% of Material Cost	1	LS	424,102	424,102
138	Structual framing / bracing				
139	HSS4x4x1/2 hanger	5	TONS	17,500	82,049
140	L6x6x1/2 continuous angle	9	TONS	17,500	159,197
141	Drilling and bolting - 4 bolts at each connection	494	EA	216	106,790
142	Platform Edge Repair				
143	Remove concrete platform edge				Previously done
144	Platform edge repair				Previously done
145	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : ATLANTIC AVE. BARCLAYS CTR.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
146	Signal Work [Each 300' length is associated with one signal light]				
147	Disconnects	80	HRS	162	12,960
148	Remove signal cables	600	LF	40	24,000
149	Remove conduit; Assuming 1"	600	LF	55	33,000
150	Install conduit in new position	600	LF	110	66,000
151	Install replacement cable; assumed single cable #12	600	LF	125	75,000
152	Re-commission / testing as required	2	EA	12,500	25,000
153	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
154	Premium Time	1,569	HRS	49	76,253
155					
156	OMIT				
157	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
158	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
159	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
160	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
161	Fixed Panels including framing and support; 4'-6" High	(2,277)	SF	750	(1,707,750)
162	Spare Parts - Approx. 10% of Material Cost	(1)	LS	229,125	(229,125)
163	Platform Edge Reconstruction work	(1)	LS	561,260	(561,260)
164	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
165	Conduit running under Platform Edge	(1,236)	LF	30	(37,080)
166					
167	Allow loss of production to work at night say 50%	1	LS	1,045,626	1,045,626
168					
169	PREMIUM ASSOCIATED WITH PSD's				$ 4,531,048

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : 8TH AVE.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	606	LF		
5	LENGTH OF THE PLATFORM EDGE =	615	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,221**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,221	LF	7	8,547
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,105	SF	12	73,260
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	123	CY	2,500	307,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,223	EA	25	30,575
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,223	EA	25	30,575
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,221	LF	95	115,995
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,221	LF	15	18,315
26	Remove existing platform tiles	1,221	LF	12	14,652
27	Sawcut existing topping concrete at perimeter of removal area	1,221	LF	5	6,105
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,326	SF	8	58,608
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-0" wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,221	SF	15	18,315

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : 8TH AVE.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Platform column restructuring**				
37	Demolition				
38	Install, maintain and remove temporary support	2	LS	15,000	30,000
39	Breakout existing platform slab for new column	2	LS	5,000	10,000
40	New Work				
41	Excavate for foundation for new column	2	EA	1,500	3,000
42	Foundation for new column	2	EA	5,000	10,000
43	New structural steel column	2	EA	20,000	40,000
44	Extend and repair beams above	2	LS	5,000	10,000
45	Grillage	2	EA	10,000	20,000
46					
47	**Equipment Room [7'-0" x 27'-6"]**				
48	Build off existing mezzanine slab		Note		
49	Form 8" wide concrete curb including dowelling to platform slab	35	LF	90	3,105
50	CMU Wall for equipment room	345	SF	45	15,525
51	Vertical connections with existing structure	20	LF	25	500
52	Roof for equipment room	193	SF	30	5,775
53	Fire rated door including frame & hardware	1	EA	2,500	2,500
54	Exterior wall finish				
55	Ceramic Tiling to match existing	345	SF	40	13,800
56	Mosaic Band to match existing - Assuming 8" high	35	LF	120	4,140
57	Concrete cove to match existing	35	LF	20	690
58	Interior Wall Finish - Paint	690	SF	5	3,450
59	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
60	Allow for 4" thick concrete pads for equipment	48	SF	20	963
61	Allowance for Mechanical Scope	1	LS	40,000	40,000
62	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
63	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
64	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
65					
66	**Automatic Platform Gates [APGs] - 4'-6" High**				
67	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
68	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
69	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
70	Platform End Gates (PEGs)	4	EA	13,000	52,000
71	Fixed Panels including framing and support; 4'-6" High	2,210	SF	750	1,657,125
72	Spare Parts - Approx. 10% of Material Cost	1	LS	226,088	226,088

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : 8TH AVE.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
73	Testing and commissioning	800	HRS	160	127,944
74	Product Warranty	1	LS	1,000,000	1,000,000
75	Allowance for Braille Signage	80	EA	2,500	200,000
76					
77	**Electrical**				
78	Electrical Upgrades				
79	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
80	Power and Lighting				
81	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
82	Allow for conduit / cable runs for power and communications under platform edge	1,221	LF	60	73,260
83	PSD Connections	1	LS	75,000	75,000
84	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
85	Power to PSD Room from EDR [Conduit & Cable]	650	LF	60	39,000
86	Reserve power to PSD Room from EDR [Conduit & Cable]	700	LF	60	42,000
87	No allowance for new lighting as if APG's are used		Note		EXCL.
88	Grounding				
89	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
90	MISC				
91	Testing and commissioning	1	EA	30,000	30,000
92	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
93					
94	**Communications**				
95	FA System				
96	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
97	CCTV coverage				
98	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
99	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
100	Berthing Technology Sensors				
101	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
102	Train Door Detection System				
103	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
104	Entrapment concerns				
105	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
106	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
107	Engineering and Testing	1,000	Hrs	160	159,930
108	Centralized monitoring/control				

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : 8TH AVE.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
109	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
110	MISC				
111	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
112	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
113	Site Survey and Inspections	1	LS	100,000	100,000
114	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
115	Furnish Test Equipment allowance	1	LS	500,000	500,000
116	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
117					
118	Training				
119	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
120					
121	Out of hours Work				
122	Allow loss of production to work at night say 50%	1	LS	3,833,100	3,833,100
123					
124	TOTAL PSD WORK:				$ 16,610,102
126					
127	ADD ALTERNATIVE				
128					
129	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
130					
131	ADD				
132	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
133	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
134	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
135	Platform End Gates (PEGs)	4	EA	18,000	72,000
136	Fixed Panels including framing and support; Assuming 8'-0" high	4,902	SF	750	3,676,365
137	Spare Parts - Approx. 10% of Material Cost	1	LS	418,702	418,702
138	Structual framing / bracing				
139	HSS4x4x1/2 hanger	5	TONS	17,500	81,069
140	L6x6x1/2 continuous angle	9	TONS	17,500	157,265
141	Drilling and bolting - 4 bolts at each connection	488	EA	216	105,494
142	Platform Edge Repair				
143	Remove concrete platform edge				Previously done
144	Platform edge repair				Previously done
145	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : 8TH AVE.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
146					
147	OMIT				
148	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
149	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
150	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
151	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
152	Fixed Panels including framing and support; 4'-6" High	(2,210)	SF	750	(1,657,125)
153	Spare Parts - Approx. 10% of Material Cost	(1)	LS	226,088	(226,088)
154	Platform Edge Reconstruction work	(1)	LS	557,110	(557,110)
155	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
156	Conduit running under Platform Edge	(1,221)	LF	30	(36,630)
157					
158	Allow loss of production to work at night say 50%	1	LS	935,059	935,059
159					
160	**PREMIUM ASSOCIATED WITH PSD's**				**$ 4,051,922**

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : FORT HAMILTON PKWY

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	625	LF		
5	LENGTH OF THE PLATFORM EDGE =	678	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,303**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,303	LF	7	9,121
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,515	SF	12	78,180
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	131	CY	2,500	327,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,305	EA	25	32,625
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,305	EA	25	32,625
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,303	LF	95	123,785
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,303	LF	15	19,545
26	Remove existing platform tiles	1,303	LF	12	15,636
27	Sawcut existing topping concrete at perimeter of removal area	1,303	LF	5	6,515
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,818	SF	8	62,544
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-0" wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,303	SF	15	19,545

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : FORT HAMILTON PKWY

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	35	LF	90	3,105
39	CMU Wall for equipment room	345	SF	45	15,525
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	345	SF	40	13,800
45	Mosaic Band to match existing - Assuming 8" high	35	LF	120	4,140
46	Concrete cove to match existing	35	LF	20	690
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,579	SF	750	1,933,875
61	Spare Parts - Approx. 10% of Material Cost	1	LS	242,693	242,693
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : FORT HAMILTON PKWY

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,303	LF	60	78,180
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	50	LF	60	3,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : FORT HAMILTON PKWY

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,877,635	3,877,635
113	TOTAL PSD WORK:				$ 16,803,086

115					
116	**ADD ALTERNATIVE**				
117					
118	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
119					
120	**ADD**				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,558	SF	750	4,168,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	448,222	448,222
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	86,426
129	L6x6x1/2 continuous angle	10	TONS	17,500	167,826
130	Drilling and bolting - 4 bolts at each connection	521	EA	216	112,579
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135					
136	**OMIT**				
137	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
141	Fixed Panels including framing and support; 4'-6" High	(2,579)	SF	750	(1,933,875)
142	Spare Parts - Approx. 10% of Material Cost	(1)	LS	242,693	(242,693)

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : FORT HAMILTON PKWY

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
143	Platform Edge Reconstruction work	(1)	LS	586,130	(586,130)
144	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
145	Conduit running under Platform Edge	(1,303)	LF	30	(39,090)
146					
147	Allow loss of production to work at night say 50%	1	LS	1,000,965	1,000,965
148					
149	**PREMIUM ASSOCIATED WITH PSD's**				**4,337,516**

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : BAY PKWY

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	686	LF		
5	LENGTH OF THE PLATFORM EDGE =	705	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,391**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,391	LF	7	9,737
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,955	SF	12	83,460
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	140	CY	2,500	350,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,393	EA	25	34,825
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,393	EA	25	34,825
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,391	LF	95	132,145
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,391	LF	15	20,865
26	Remove existing platform tiles	1,391	LF	12	16,692
27	Sawcut existing topping concrete at perimeter of removal area	1,391	LF	5	6,955
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,346	SF	8	66,768
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-0" wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,391	SF	15	20,865

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : BAY PKWY

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	35	LF	90	3,105
39	CMU Wall for equipment room	345	SF	45	15,525
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	345	SF	40	13,800
45	Mosaic Band to match existing - Assuming 8" high	35	LF	120	4,140
46	Concrete cove to match existing	35	LF	20	690
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,975	SF	750	2,230,875
61	Spare Parts - Approx. 10% of Material Cost	1	LS	260,513	260,513
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : BAY PKWY

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,391	LF	60	83,460
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	50	LF	60	3,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : BAY PKWY

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,988,520	3,988,520
112					
113	TOTAL PSD WORK:				$ 17,283,586

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	6,262	SF	750	4,696,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	479,902	479,902
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	92,175
129	L6x6x1/2 continuous angle	10	TONS	17,500	179,161
130	Drilling and bolting - 4 bolts at each connection	556	EA	216	120,182
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135					
136	OMIT				
137	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
141	Fixed Panels including framing and support; 4'-6" High	(2,975)	SF	750	(2,230,875)
142	Spare Parts - Approx. 10% of Material Cost	(1)	LS	260,513	(260,513)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : BAY PKWY

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
143	Platform Edge Reconstruction work	(1)	LS	618,310	(618,310)
144	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
145	Conduit running under Platform Edge	(1,391)	LF	30	(41,730)
147	Allow loss of production to work at night say 50%	1	LS	1,071,383	1,071,383
148					
149	**PREMIUM ASSOCIATED WITH PSD's**				**$ 4,642,660**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : AVENUE U

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	606	LF		
5	LENGTH OF THE PLATFORM EDGE =	598	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,204**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,204	LF	7	8,428
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,020	SF	12	72,240
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	121	CY	2,500	302,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,206	EA	25	30,150
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,206	EA	25	30,150
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,204	LF	95	114,380
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,204	LF	15	18,060
26	Remove existing platform tiles	1,204	LF	12	14,448
27	Sawcut existing topping concrete at perimeter of removal area	1,204	LF	5	6,020
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,224	SF	8	57,792
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-0" wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,204	SF	15	18,060

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : AVENUE U

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [16'-0" x 12'-0"]**				
37	Build off existing mezzanine slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	56	LF	90	5,040
39	CMU Wall for equipment room	560	SF	45	25,200
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	192	SF	30	5,760
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	560	SF	40	22,400
45	Mosaic Band to match existing - Assuming 8" high	56	LF	120	6,720
46	Concrete cove to match existing	56	LF	20	1,120
47	Interior Wall Finish - Paint	560	SF	5	2,800
48	Allow for Misc. floor & ceiling finishes	192	SF	15	2,880
49	Allow for 4" thick concrete pads for equipment	48	SF	20	960
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,133	SF	750	1,599,750
61	Spare Parts - Approx. 10% of Material Cost	1	LS	222,645	222,645
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : AVENUE U

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,204	LF	60	72,240
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	750	LF	60	45,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	800	LF	60	48,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : AVENUE U

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,784,947	3,784,947
112					
113	TOTAL PSD WORK:				$ 16,401,437
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,766	SF	750	3,574,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	412,582	412,582
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	79,959
129	L6x6x1/2 continuous angle	9	TONS	17,500	155,075
130	Drilling and bolting - 4 bolts at each connection	482	EA	216	104,026
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135					
136	OMIT				
137	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
138	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
139	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
140	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
141	Fixed Panels including framing and support; 4'-6" High	(2,133)	SF	750	(1,599,750)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : AVENUE U

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
142	Spare Parts - Approx. 10% of Material Cost	(1)	LS	222,645	(222,645)
143	Platform Edge Reconstruction work	(1)	LS	550,240	(550,240)
144	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
145	Conduit running under Platform Edge	(1,204)	LF	30	(36,120)
146					
147	Allow loss of production to work at night say 50%	1	LS	921,651	921,651
148					
149	**PREMIUM ASSOCIATED WITH PSD's**				**$ 3,993,823**

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : CONEY ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	615	LF		
5	LENGTH OF THE PLATFORM EDGE =	616	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,231**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,231	LF	7	8,617
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,155	SF	12	73,860
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,233	EA	25	30,825
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,233	EA	25	30,825
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,231	LF	95	116,945
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,231	LF	15	18,465
26	Remove existing platform tiles	1,231	LF	12	14,772
27	Sawcut existing topping concrete at perimeter of removal area	1,231	LF	5	6,155
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,386	SF	8	59,088
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Platform width i.e. 27'-6" wide strip	620	SF	8	4,960
30	New Work				
31	New concrete topping to match existing	1,231	SF	15	18,465

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : CONEY ISLAND

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	620	SF	15	9,300
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [12'-0" x 16'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	56	LF	90	5,040
39	CMU Wall for equipment room	560	SF	45	25,200
40	Vertical connections with existing structure	-	LF	25	-
41	Roof for equipment room	192	SF	30	5,760
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	560	SF	40	22,400
45	Mosaic Band to match existing - Assuming 8" high	56	LF	120	6,720
46	Concrete cove to match existing	56	LF	20	1,120
47	Interior Wall Finish - Paint	560	SF	5	2,800
48	Allow for Misc. floor & ceiling finishes	192	SF	15	2,880
49	Allow for 4" thick concrete pads for equipment	48	SF	20	960
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,255	SF	750	1,690,875
61	Spare Parts - Approx. 10% of Material Cost	1	LS	228,113	228,113
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : CONEY ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,231	LF	60	73,860
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : CONEY ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,796,563	3,796,563
112					
113	**TOTAL PSD WORK:**				**$ 16,451,775**
115					
116	**ADD ALTERNATIVE**				
117					
118	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
119					
120	**ADD**				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,982	SF	750	3,736,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	422,302	422,302
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,723
129	L6x6x1/2 continuous angle	9	TONS	17,500	158,553
130	Drilling and bolting - 4 bolts at each connection	492	EA	216	106,358
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	120	HRS	162	19,440
137	Remove signal cables	900	LF	40	36,000
138	Remove conduit; Assuming 1"	900	LF	55	49,500
139	Install conduit in new position	900	LF	110	99,000
140	Install replacement cable; assumed single cable #12	900	LF	125	112,500
141	Re-commission / testing as required	3	EA	12,500	37,500
142	Engineering / Shop Drawings / Etc.	3	EA	7,500	22,500
143	Premium Time	2,353	HRS	49	114,356

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : CONEY ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,255)	SF	750	(1,690,875)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	228,113	(228,113)
152	Platform Edge Reconstruction work	(1)	LS	560,710	(560,710)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,231)	LF	30	(36,930)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,090,317	1,090,317
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,724,706

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : QUEENSBORO PLAZA

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE UPPER PLATFORM EDGE=	622	LF		
5	LENGTH OF THE LOWER PLATFORM EDGE =	684	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,306**	**LF**		
7	NUMBER OF TRAIN CARS ON W TRAIN TRACK =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,306	LF	7	9,142
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,530	SF	12	78,360
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	132	CY	2,500	330,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,308	EA	25	32,700
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,308	EA	25	32,700
19	Cast in assemblies for PSD holding down bolts	320	EA	180	57,600
20	Polyethylene edge strip	1,306	LF	95	124,070
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,306	LF	15	19,590
26	Remove existing platform tiles	1,306	LF	12	15,672
27	Sawcut existing topping concrete at perimeter of removal area	1,306	LF	5	6,530
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,836	SF	8	62,688
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,306	SF	15	19,590

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : QUEENSBORO PLAZA

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	69	LF	90	6,210
39	CMU Wall for equipment room	690	SF	45	31,050
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	203	SF	30	6,075
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	690	SF	40	27,600
45	Mosaic Band to match existing - Assuming 8" high	69	LF	120	8,280
46	Concrete cove to match existing	69	LF	20	1,380
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	203	SF	15	3,038
49	Allow for 4" thick concrete pads for equipment	51	SF	20	1,013
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,592	SF	750	1,944,000
61	Spare Parts - Approx. 10% of Material Cost	1	LS	243,300	243,300
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,500,000	1,500,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : QUEENSBORO PLAZA

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,306	LF	60	78,360
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	500	LF	60	30,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	550	LF	60	33,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	Remove, store and reinstall existing signal light	1	EA	5,000	5,000
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	1,000	Hrs	160	159,930
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : QUEENSBORO PLAZA

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	Training				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	Out of hours Work				
112	Allow loss of production to work at night say 50%	1	LS	4,043,683	4,043,683
113					
114	TOTAL PSD WORK:				$ 17,522,627
116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	N/A	EA	25,000	-
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	N/A	EA	15,000	-
124	Double egress/service gate in the center of the platform; #1 per Platform	N/A	EA	30,000	-
125	Platform End Gates (PEGs)	N/A	EA	18,000	-
126	Fixed Panels including framing and support; Assuming 8'-0" high	N/A	SF	750	-
127	Spare Parts - Approx. 10% of Material Cost	N/A	LS	-	-
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	N/A	TONS	17,500	-
130	L6x6x1/2 continuous angle	N/A	TONS	17,500	-
131	Drilling and bolting - 4 bolts at each connection	N/A	EA	216	-
132	Platform Edge Repair				
133	Remove concrete platform edge				Previously done
134	Platform edge repair				Previously done
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
136	Signal Work [Each 300' length is associated with one signal light]				
137	Disconnects	N/A	HRS	162	-
138	Remove signal cables	N/A	LF	40	-
139	Remove conduit; Assuming 1"	N/A	LF	55	-
140	Install conduit in new position	N/A	LF	110	-
141	Install replacement cable; assumed single cable #12	N/A	LF	125	-
142	Re-commission / testing as required	N/A	EA	12,500	-
143	Engineering / Shop Drawings / Etc.	N/A	EA	7,500	-
144	Premium Time	N/A	HRS	49	-

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : QUEENSBORO PLAZA

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	N/A	EA	15,000	-
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	N/A	EA	10,500	-
149	Double egress/service gate in the center of the platform; #1 per Platform	N/A	EA	20,000	-
150	Platform End Gates (PEGs)	N/A	EA	13,000	-
151	Fixed Panels including framing and support; 4'-6" High	N/A	SF	750	-
152	Spare Parts - Approx. 10% of Material Cost	N/A	LS	243,300	-
153	Platform Edge Reconstruction work	N/A	LS	531,360	-
154	Remove allowance for cast in sleeves for LV & HV power	N/A	EA	110	-
155	Conduit running under Platform Edge	N/A	LF	30	-
156					
157	Allow loss of production to work at night say 50%	N/A	LS	-	-
158					
159	PREMIUM ASSOCIATED WITH PSD's				$ -

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : 5TH AVE./59TH ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	615	LF		
5	LENGTH OF THE PLATFORM EDGE [ASTORIA BOUND] =	615	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,230**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,230	LF	7	8,610
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,150	SF	12	73,800
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,232	EA	25	30,800
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,232	EA	25	30,800
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,230	LF	95	116,850
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,230	LF	15	18,450
26	Remove existing platform tiles	1,230	LF	12	14,760
27	Sawcut existing topping concrete at perimeter of removal area	1,230	LF	5	6,150
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,380	SF	8	59,040
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,230	SF	15	18,450

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : 5TH AVE./59TH ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room A [7'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,780
39	CMU Wall for equipment room	420	SF	45	18,900
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	203	SF	30	6,075
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	420	SF	40	16,800
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	5,040
46	Concrete cove to match existing	42	LF	20	840
47	Interior Wall Finish - Paint	420	SF	5	2,100
48	Allow for Misc. floor & ceiling finishes	203	SF	15	3,038
49	Allow for 4" thick concrete pads for equipment	51	SF	20	1,013
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
61	Spare Parts - Approx. 10% of Material Cost	1	LS	227,910	227,910
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : 5TH AVE./59TH ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,230	LF	60	73,800
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	700	LF	60	42,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	750	LF	60	45,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : 5TH AVE./59TH ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,811,576	3,811,576
112					
113	**TOTAL PSD WORK:**				**$ 16,516,828**
115					
116	**ADD ALTERNATIVE**				
117					
118	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
119					
120	**ADD**				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,974	SF	750	3,730,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	421,942	421,942
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,657
129	L6x6x1/2 continuous angle	9	TONS	17,500	158,424
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	120	HRS	162	19,440
137	Remove signal cables	900	LF	40	36,000
138	Remove conduit; Assuming 1"	900	LF	55	49,500
139	Install conduit in new position	900	LF	110	99,000
140	Install replacement cable; assumed single cable #12	900	LF	125	112,500
141	Re-commission / testing as required	3	EA	12,500	37,500
142	Engineering / Shop Drawings / Etc.	3	EA	7,500	22,500
143	Premium Time	2,353	HRS	49	114,356

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : 5TH AVE./59TH ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,250)	SF	750	(1,687,500)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	227,910	(227,910)
152	Platform Edge Reconstruction work	(1)	LS	560,600	(560,600)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,230)	LF	30	(36,900)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,083,997	1,083,997
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,697,318

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	703	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	703	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,406**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,406	LF	7	9,842
14	Remove 5' wide section of 3" deep structural slab to platform edge	7,030	SF	12	84,360
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	142	CY	2,500	355,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,408	EA	25	35,200
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,408	EA	25	35,200
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,406	LF	95	133,570
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,406	LF	15	21,090
26	Remove existing platform tiles	1,406	LF	12	16,872
27	Sawcut existing topping concrete at perimeter of removal area	1,406	LF	5	7,030
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,436	SF	8	67,488
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10' wide strip	320	SF	8	2,560
30	New Work				
31	New concrete topping to match existing	1,406	SF	15	21,090

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	320	SF	15	4,800
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room#1 [7'-6" x 17'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	32	LF	90	2,880
39	CMU Wall for equipment room	320	SF	45	14,400
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	128	SF	30	3,825
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	320	SF	40	12,800
45	Mosaic Band to match existing - Assuming 8" high	32	LF	120	3,840
46	Concrete cove to match existing	32	LF	20	640
47	Interior Wall Finish - Paint	320	SF	5	1,600
48	Allow for Misc. floor & ceiling finishes	128	SF	15	1,913
49	Allow for 4" thick concrete pads for equipment	32	SF	20	638
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Equipment Room#2 [7'-6" x 17'-0"]**				
56	Build off existing platform slab		Note		
57	Form 8" wide concrete curb including dowelling to platform slab	32	LF	90	2,880
58	CMU Wall for equipment room	320	SF	45	14,400
59	Vertical connections with existing structure	20	LF	25	500
60	Roof for equipment room	128	SF	30	3,825
61	Fire rated door including frame & hardware	1	EA	2,500	2,500
62	Exterior wall finish				
63	Ceramic Tiling to match existing	320	SF	40	12,800
64	Mosaic Band to match existing - Assuming 8" high	32	LF	120	3,840
65	Concrete cove to match existing	32	LF	20	640
66	Interior Wall Finish - Paint	320	SF	5	1,600
67	Allow for Misc. floor & ceiling finishes	128	SF	15	1,913
68	Allow for 4" thick concrete pads for equipment	32	SF	20	638
69	Allowance for Mechanical Scope	1	LS	40,000	40,000
70	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
71	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
72	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
73					
74	**Automatic Platform Gates [APGs] - 4'-6" High**				
75	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
76	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
77	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
78	Platform End Gates (PEGs)	4	EA	13,000	52,000
79	Fixed Panels including framing and support; 4'-6" High	3,042	SF	750	2,281,500
80	Spare Parts - Approx. 10% of Material Cost	1	LS	263,550	263,550
81	Testing and commissioning	800	HRS	160	127,944
82	Product Warranty	1	LS	1,000,000	1,000,000
83	Allowance for Braille Signage	80	EA	2,500	200,000
84					
85	**Electrical**				
86	Electrical Upgrades				
87	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
88	Power and Lighting				
89	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
90	Allow for conduit / cable runs for power and communications under platform edge	1,406	LF	60	84,360
91	PSD Connections	1	LS	75,000	75,000
92	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
93	Power to PSD Rooms from EDR [Conduit & Cable]	350	LF	60	21,000
94	Reserve power to PSD Room from EDR [Conduit & Cable]	400	LF	60	24,000
95	No allowance for new lighting as if APG's are used		Note		EXCL.
96	Grounding				
97	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
98	MISC				
99	Testing and commissioning	1	EA	30,000	30,000
100	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
101					
102	**Communications**				
103	FA System				
104	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
105	CCTV coverage				
106	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
107	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
108	Berthing Technology Sensors				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
109	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
110	Train Door Detection System				
111	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
112	Entrapment concerns				
113	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
114	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
115	Engineering and Testing	1,000	Hrs	160	159,930
116	Centralized monitoring/control				
117	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
118	MISC				
119	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
120	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
121	Site Survey and Inspections	1	LS	100,000	100,000
122	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
123	Furnish Test Equipment allowance	1	LS	500,000	500,000
124	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
125					
126	Training				
127	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
128					
129	Out of hours Work				
130	Allow loss of production to work at night say 50%	1	LS	4,093,287	4,093,287
131					
132	TOTAL PSD WORK:				$ 17,737,576
134					
135	ADD ALTERNATIVE				
136					
137	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
138					
139	ADD				
140	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
141	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
142	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for N - Line Stations

7-Jan-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
143	Platform End Gates (PEGs)	4	EA	18,000	72,000
144	Fixed Panels including framing and support; Assuming 8'-0" high	6,382	SF	750	4,786,365
145	Spare Parts - Approx. 10% of Material Cost	1	LS	485,302	485,302
146	Structual framing / bracing				
147	HSS4x4x1/2 hanger	5	TONS	17,500	93,155
148	L6x6x1/2 continuous angle	10	TONS	17,500	181,093
149	Drilling and bolting - 4 bolts at each connection	562	EA	216	121,478
150	Platform Edge Repair				
151	Remove concrete platform edge				Previously done
152	Platform edge repair				Previously done
153	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
154	Signal Work [Each 300' length is associated with one signal light]				
155	Disconnects	120	HRS	162	19,440
156	Remove signal cables	900	LF	40	36,000
157	Remove conduit; Assuming 1"	900	LF	55	49,500
158	Install conduit in new position	900	LF	110	99,000
159	Install replacement cable; assumed single cable #12	900	LF	125	112,500
160	Re-commission / testing as required	3	EA	12,500	37,500
161	Engineering / Shop Drawings / Etc.	3	EA	7,500	22,500
162	Premium Time	2,353	HRS	49	114,356
163					
164	OMIT				
165	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
166	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
167	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
168	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
169	Fixed Panels including framing and support; 4'-6" High	(3,042)	SF	750	(2,281,500)
170	Spare Parts - Approx. 10% of Material Cost	(1)	LS	263,550	(263,550)
171	Platform Edge Reconstruction work	(1)	LS	624,960	(624,960)
172	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
173	Conduit running under Platform Edge	(1,406)	LF	30	(42,180)
175	Allow loss of production to work at night say 50%	1	LS	1,230,276	1,230,276
176					
177	PREMIUM ASSOCIATED WITH PSD's				$ 5,331,194

New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR 'Q' SERVICE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

FINAL SUBMITTAL DATE: June 24, 2019

STV 100 Years

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Appendices

Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. Our Tier 1 analysis found no instances of door misalignment between car classes for this line. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 34 newly evaluated stations, 26 have been found to be not suitable for the installation of PSDs.

[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to half-height barriers]

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues: the platform edge barriers are 15" wide. Where an existing object (wall, stair, and railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Under the following conditions, PSDs are declared infeasible:
  - Limit the ability of a wheelchair to turn within a 5'-0" circle
  - Limit path of travel to less than a 32" pinch width (defined as an obstruction that measures less than 2'-0" longitudinally, i.e. columns)
  - Limit path of travel to be less than a 36" corridor as defined by the edge of a staircase, railing or room
- Insufficient space for the PSD equipment room: the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow: due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements regarding the placement of these new barriers in an existing station environment.
- Structural considerations: existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic

upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.

- Columns at platform edge: at certain stations, the columns are positioned 16" to 24" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space.

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the previously proposed 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the PSD barriers and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is used for refuse removal at most of the Q-line stations. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the (off) loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in damage from these carts along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process.

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 23% of the 'Q' Line Stations. Total implementation cost would be $253.2 for APGs and $240.3M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; that estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of $931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 8 feasible stations, the aggregate annual maintenance cost would be $7.4M.

Summary Table

(23% Feasible 8/34)

MRN No.	Station Names	Station Type	Platform Type	Feasibility	Issues/Reason for Failure	Cost APGs	Cost PSDs
009	57th Street 7th Ave	SUB	Island	No	ADA Clearance	-	-
010	49th Street	SUB	Side	Yes	-	$33.5M	$43.5M
011	Times Square 42nd Street	SUB	Island	No	ADA Clearance	-	-
012	34th Street Herald Sq.	SUB	Island	No	ADA Clearance	-	-
013	28th Street	SUB	Side	No	No PSD Room Location	-	-
014	23rd Street	SUB	Side	No	ADA Clearance	-	-
015	14th St. Union Square	SUB	Island	No	ADA Clearance	-	-
016	8th St. NYU	SUB	Side	No	ADA Clearance	-	-
017	Prince Street	SUB	Side	No	ADA Clearance	-	-
019	Canal Street (LL)	SUB	Side	No	No PSD Room Location	-	-
026	Dekalb Avenue	SUB	Island	No	ADA Clearance		
040	Atlantic Ave. Barclays Ctr.	SUB	Island	No	ADA Clearance	-	-
041	7th Avenue	SUB	Side	No	Columns too close to edge	-	-
042	Prospect Park	CUT	Island	No	ADA Clearance	-	-
043	Parkside Avenue	CUT	Side	No	ADA Clearance	-	-
044	Church Avenue	CUT	Island	No	ADA Clearance	-	-
045	Beverly Road	CUT	Side	No	ADA Clearance	-	-
046	Cortelyou Road	CUT	Side	No	ADA Clearance	-	-
047	Newkirk Plaza	CUT	Island	No	ADA Clearance	-	-
048	Avenue H	EMB	Side	No	Non-Compliant Egress Path	-	-
049	Avenue J	EMB	Side	Yes	-	$31.6M	NA
050	Avenue M	EMB	Side	No	Non-Compliant Egress Path	-	-
051	Kings Highway	EMB	Island	No	ADA Clearance	-	-
052	Avenue U	EMB	Side	No	ADA Clearance	-	-
053	Neck Road	EMB	Side	Yes	-	$31.5M	NA
054	Sheepshead Bay	EMB	Island	No	ADA Clearance	-	-
055	Brighton Beach	ELV	Island	No	ADA Clearance	-	-
056	Ocean Parkway	ELV	Island	No	ADA Clearance	-	-
057	West 8th St. New York	ELV	Side	No	ADA Clearance	-	-
058	Coney Island	ELV	Island	Yes	-	$31.0M	$40.0M
223	Lexington Avenue 63rd St.	SUB	Island	Yes	-	$31.6M	$39.2M
475	96th St.	SUB	Island	Yes	-	$31.2M	$39.2M
476	86th St.	SUB	Island	Yes	-	$31.4M	$39.1M
477	72nd St.	SUB	Island	Yes	-	$31.4M	$39.3M
					TOTAL	$253.2M	$240.3M

1.0 Station Assessments

1.01 – MR 009 | 57th Street 7th Avenue Station

Summary: *57th Street 7th Avenue is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at the center stairs as the remaining width would be 27" (see figure 1).*

Description

The 57th Street Station is an underground station consisting of two center / island platforms. The platforms are approximately 19'-8" wide. The platforms are straight with two rows of columns at 42" from the edge of the platform. At four staircases columns flank the stair. The implementation of a platform edge barrier would reduce this width to 27" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-compliant ADA dimension*
57th Street Station

1.02 – MR 010 | 49th Street Station

Summary: *49th Street Station is feasible for both APGs and PSDs. There are two ceiling mounted signals located at the center of the southbound platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The 49th Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns on the platforms. The platform width varies from approximately 7'-0" to 14'-8". On the southbound platform there are two ceiling mounted signals located above the platform edge, with a vertical clearance of at least 7'-6". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting

Equipment Room

The equipment room could be located as a split room, with one at the south control area of the southbound, and one located at the north control area of the southbound. (see **Figure 1, Figure 2**). The proposed room dimension are 16'-0" x 7'-6".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

This platform edge was re-constructed within the last thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

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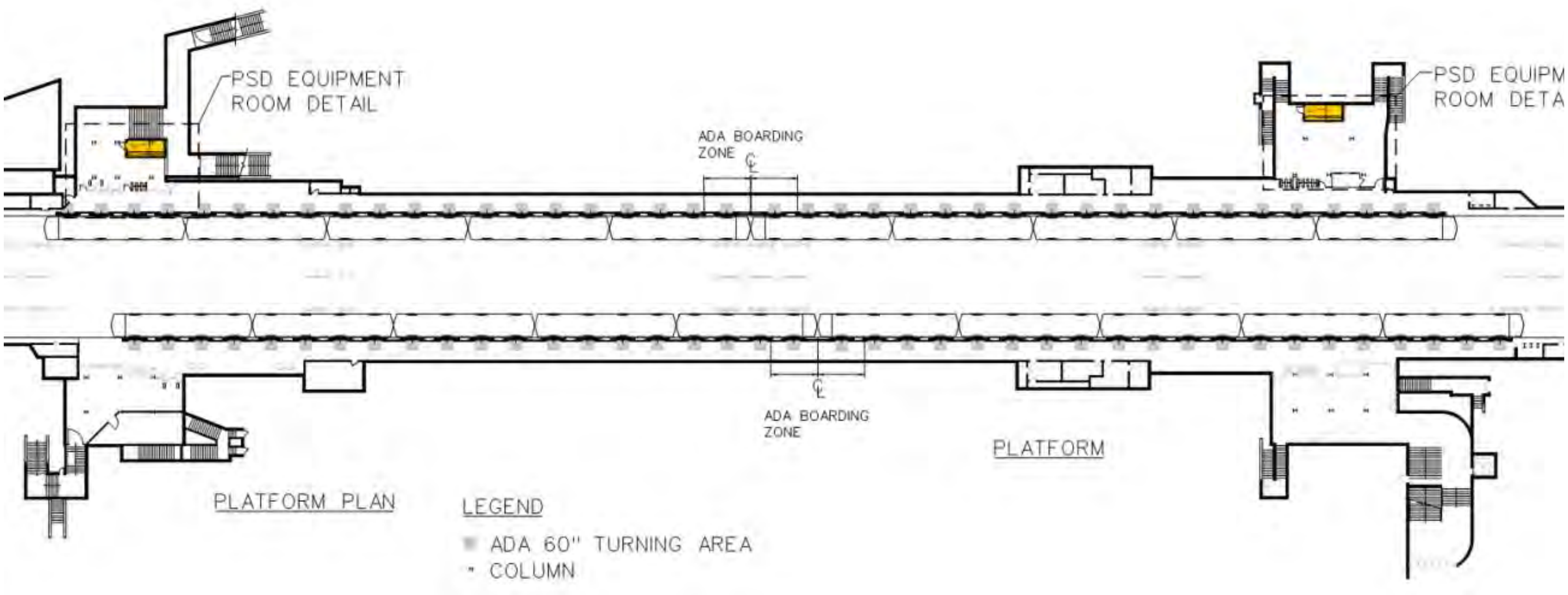

Figure 1 *– Overall plan*
49th Street Station

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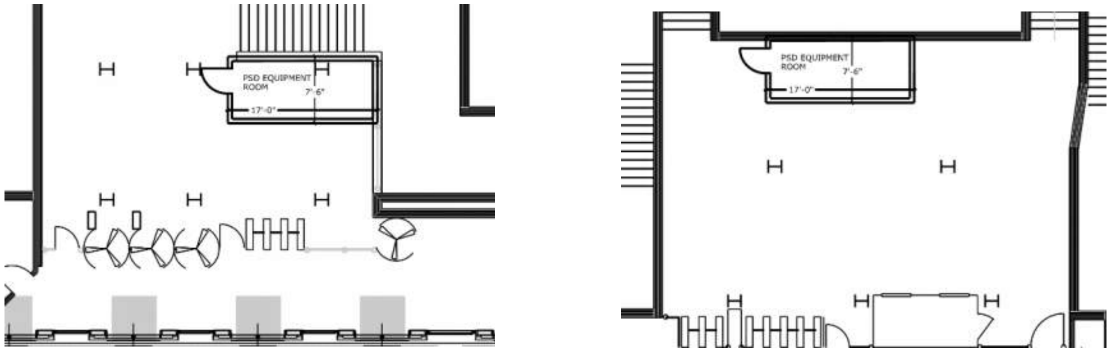

***Figure 2** – PSD Equipment Room Detail*
49th Street Station

Platform obstructions within 5' of edge:

None

Lighting:

Existing lighting: Throughout both platforms; linear fluorescent; perpendicular to the platform edge mounted in the ceiling coffers. No lighting reconfiguration will be required as part of a PSD installation.

***Figure 3** – General platform view*
49th Street Station

Power:

This station has adequate capacity to support the implementation of a APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal Service)

Station Name	49th Street
Peak Demand Load from ConEd Report, Last **12** Months, (kW)	45.2
Apparent Power (kVA)	56.5
Station Peak Demand Load, Max Current, (A)	156.9
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	352
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	449
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Meter reading is for 12 months.

Table 1. Power Capacity Analysis (Normal Service)

Station
Power Capacity Analysis (Reserve Service)

Station Name	49th Street
Peak Demand Load from ConEd Report, Last **12** Months, (kW)	27.2
Apparent Power (kVA)	34.0
Station Peak Demand Load, Max Current, (A)	94.5
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	289
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	511
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. Meter reading is for 12 months.

Table 2. Power Capacity Analysis (Reserve)

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $33.5M to install APGs and $43.5M to install PSDs (See Appendix E)

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1.03 – MR 011 | Times Square / 42nd Street Station

Summary: *Times Square / 42nd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 19" (see figure 1). (Note: this report covers only the Broadway BMT platforms; see reports for the Shuttle, 7, 1,2,3-line for the remainder of the station)*

Description

Times Square / 42nd Street Station is a below-grade station consisting of two center / island platforms. The platform width is 19-4" throughout. The platforms are straight with two rows of columns at 3'-8" from edge of platform. At the south end of the platforms, the columns flanking an equipment room are 2'-10" from the platform edge. The implementation of a platform edge barrier would reduce this width to 19" or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** –platform*
42nd Street / Times Square Station

1.04 – MR 012 | 34th Street / Herald Square Station

Summary: *34th Street / Herald Square Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1). (Note: this report covers only the Broadway BMT platforms; see the B, D, F, M-line report for the remainder of the station)*

Description

34th Street / Herald Square Station is a below-grade station consisting of two center / island platforms. The platform width is 19-8" throughout. The platforms are straight with two rows of columns at 3'-4" from edge of platform. On the center / island platform the columns flank multiple staircases. The implementation of a platform edge barrier would reduce this width to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *–platform*
34th Street Station

1.05 – MR 013 | 28th Street Station

Summary: *28th Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

28th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns 3'-6" from the platform edge at each platform, though approximately one third of the platform is column-free. The platform width varies from 6'-0" to 9'-5. Due to the extremely limited width of the existing platforms and control areas, there is no available space for the equipment room. Figure 2, below, shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the southbound control area. The northbound control area is similar..

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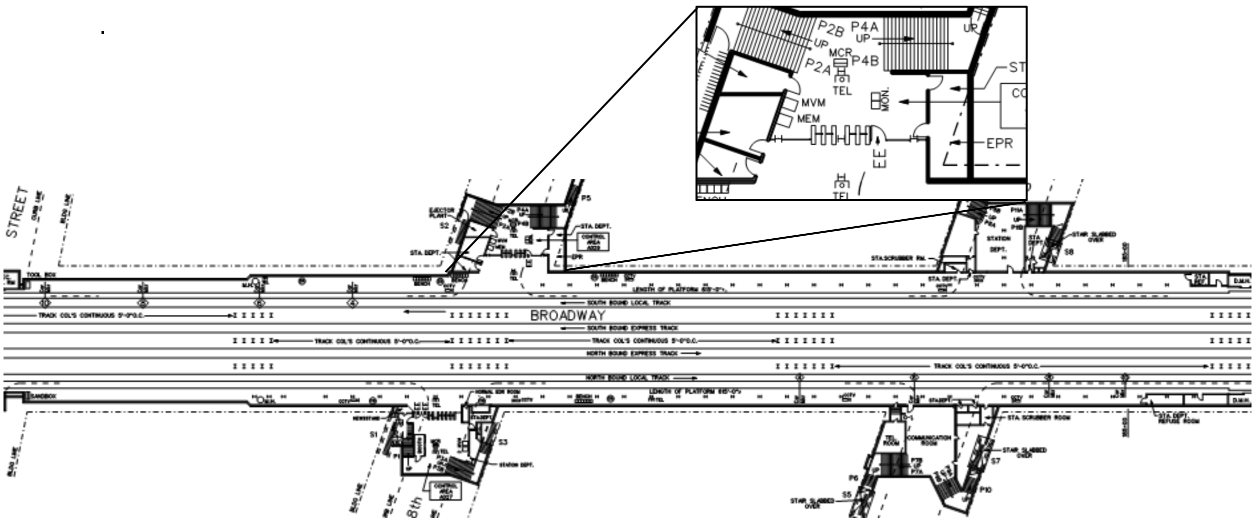

Figure 1 *– Station Plan- 28th Street Station*

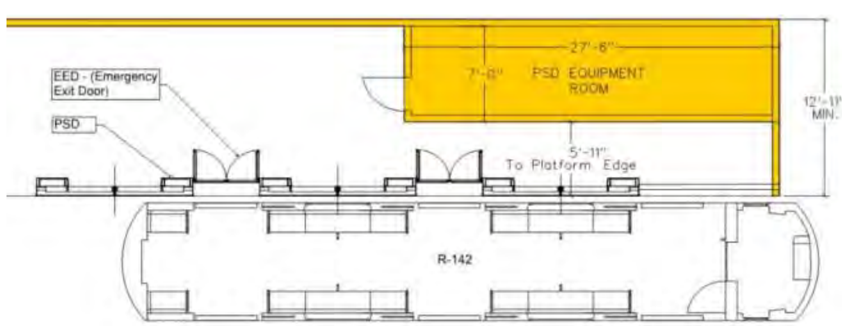

Figure 2 – *Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimensions)

1.06 – MR 014 | 23rd Street

Summary: *23rd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at the northbound platform control area as the remaining width would be 27" (see figure 1).*

Description

23rd Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns 3'-8" from the platform edge at each platform. The platform width varies from 6'-0" to 11'-2" in width. The entry / exit turnstiles at the south entrance of the northbound platform are positioned with minimal clearance of 18" to the adjacent columns. The remaining space between the columns and the platform edge measures 42". The implementation of a platform edge barrier would reduce this width to 27" or less which would not allow for ADA compliant wheelchair movement. See figures 1and 2 below. The plan in figure 1 demonstrates that there is no alternative location for the turnstiles / railings.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

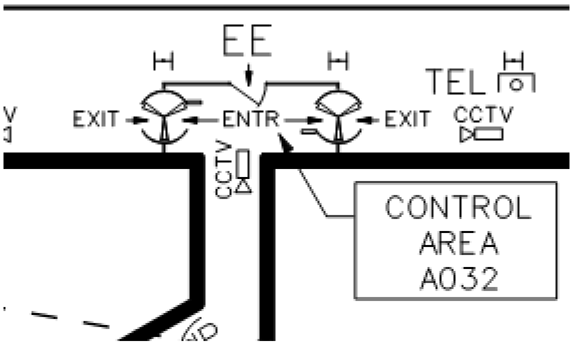

Figure 1 *– Non-Compliant ADA condition - 23rd Street*

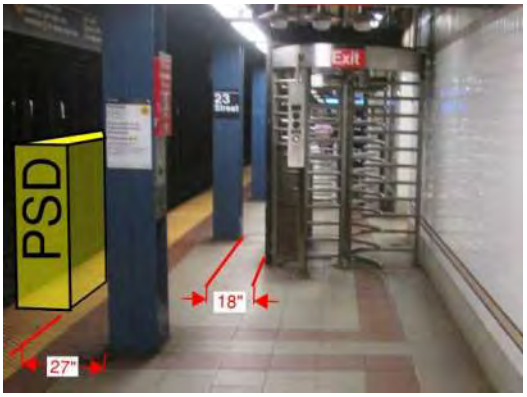

Figure 2 *– Non-Compliant ADA condition - 23rd Street*

1.07 – MR 015 | 14th Street / Union Square Station

Summary: *14th Street / Union Square Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 27" (see figure 1). (Note: this report covers only the Broadway BMT platforms; see reports for the L-line and 4,5,6-line for the remainder of this complex)*

Description

14th Street / Union Square Station is a below-grade station consisting of two center / island platforms. The platform width is 18-8" throughout. The platforms are straight with two rows of columns at 3'-6" from edge of platform; these columns flank multiple staircases. The implementation of a platform edge barrier would reduce this width to 27" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
14th Street / Union Square

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1.08 – MR 016 | 8th Street Station

Summary: 8th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1).

Description

8th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns 3'-4" from the platform edge at each platform. The platform width varies from 9'-6" to 11'-0" in width. The south street stair at each platform is positioned with minimal clearance to the adjacent columns. The remaining space between the columns and the platform edge measures 40". The implementation of a platform edge barrier would reduce this width to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 below.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
8th Street Station

1.09 – MR 017 | Prince Street Station

Summary: *Prince Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 21" (see figure 1).*

Description

Prince Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 7'-6' to 8'-8". Platform width at the south end of the southbound platform is 36". The implementation of a platform edge barrier would reduce this width to 21" or less below the required minimum of 36". The remaining 21" or less* would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – Non-Compliant ADA condition
Prince Street

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1.10 – MR 019 | Canal Street Station Lower Level

Summary: *Canal Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

Canal Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The typical width of the platforms ranges from 7'-0' to 9'-6". Platform widths are not wide enough to accommodate an equipment room (Figure 2) and the mezzanine cannot accommodate a full-size equipment room without constraining passenger flow.

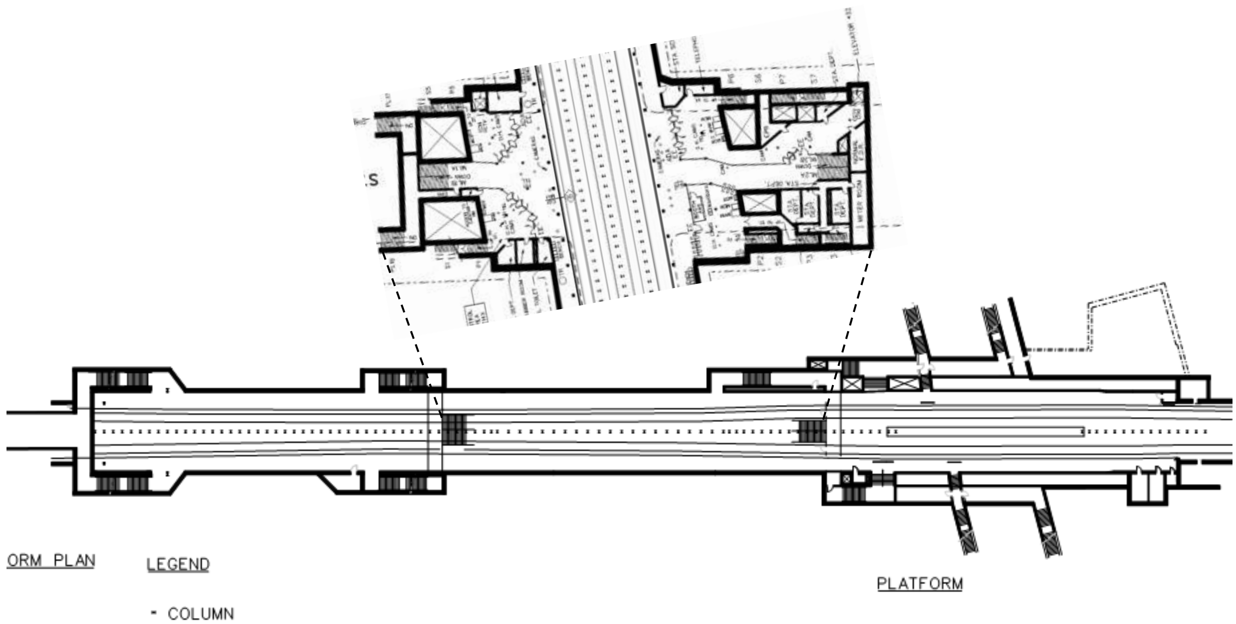

Figure 1 *– Station layout showing lack of space*
Canal Street Station Lower Level – Mezzanine shown above

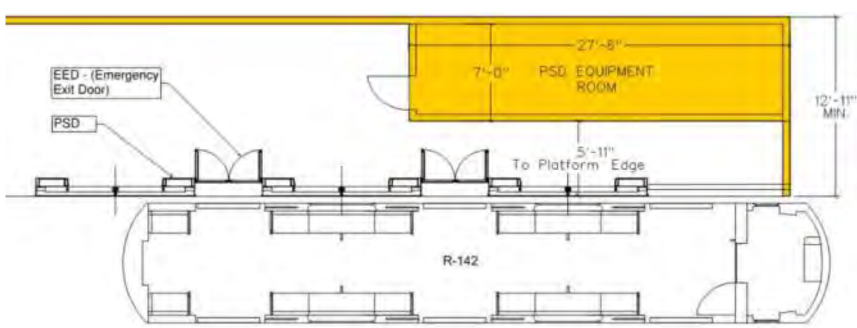

Figure 2 – *Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimensions)

1.11 – MR 026 | Dekalb Ave Station

Summary: *Dekalb Ave Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 29" (see figure 1).*

Description

Dekalb Ave Station is a below-grade station with two center / island platforms. The platform structures are cast-in-place concrete. The platform columns are spaced 10'-10" on center, and column faces typically measure 3'-8" from the platform edge. The platform width is 15'-8" throughout. At the platform staircases, the columns flanking the stairs measure 3'-8" from the platform edge and are touching the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 44" to 29" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

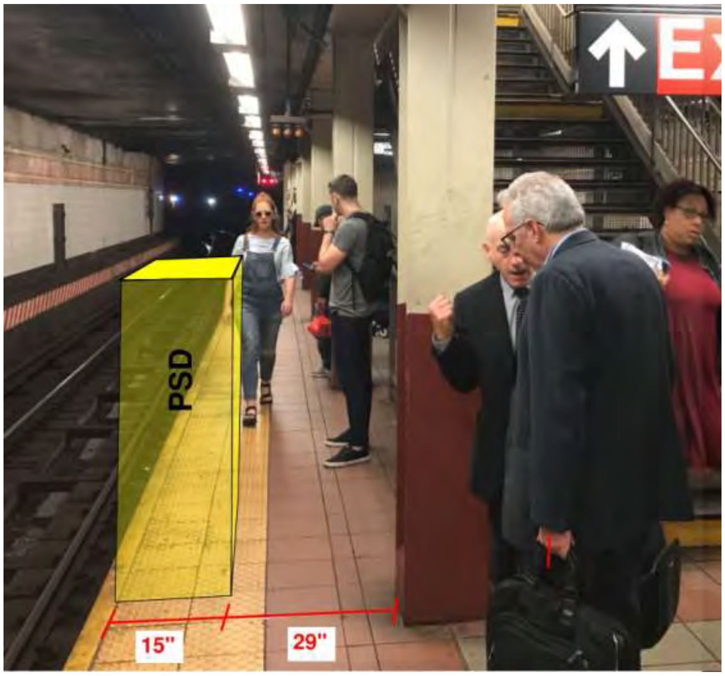

Figure 1 *– Non-Compliant ADA condition Dekalb Avenue Station*

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1.12 – MR 040 | Atlantic Avenue Barclay Center Station

Summary: *Atlantic Avenue Barclay Center Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 8" (see figure 1).*

Description

The Atlantic Avenue Barclay Center Station is a below-grade station with one center / island platform. The platform structure is cast-in-place concrete. There are two rows of columns which lie 23" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum pinch point width of 32". The remaining 8" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.=

***Figure 1** – Non-compliant ADA condition*
Atlantic Avenue Barclay Center Station

1.13 – MR 041 | 7th Avenue Flatbush Avenue Station

Summary: *7th Avenue Flatbush Avenue Station is not feasible for both APGs and PSDs as the columns which are located 12" from the platform edge would prohibit the installation of a 15"-wide PSD system.*

Description:

7th Avenue Flatbush Avenue Street Station is a below-grade station consisting of two side platforms. It is not feasible for both APGs and PSDs due to the presence of structural columns on the platforms which are within the envelope that the proposed PSD system(s) would occupy. The columns pictured in Figure 1 measure approximately 12" from the platform edge, which would prevent a continuous 15"-wide barrier from being installed. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 12" from the edge*
7th Avenue Flatbush Avenue Station

1.14 – MR 042 | Prospect Park

Summary: *Prospect Park Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 31" (see figure 1).*

Description

The Prospect Park Station is an open cut station with two straight center / island platforms. The platform structures are cast-in-place concrete. The width of the platforms at the north end is 3'-10". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 31" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.=

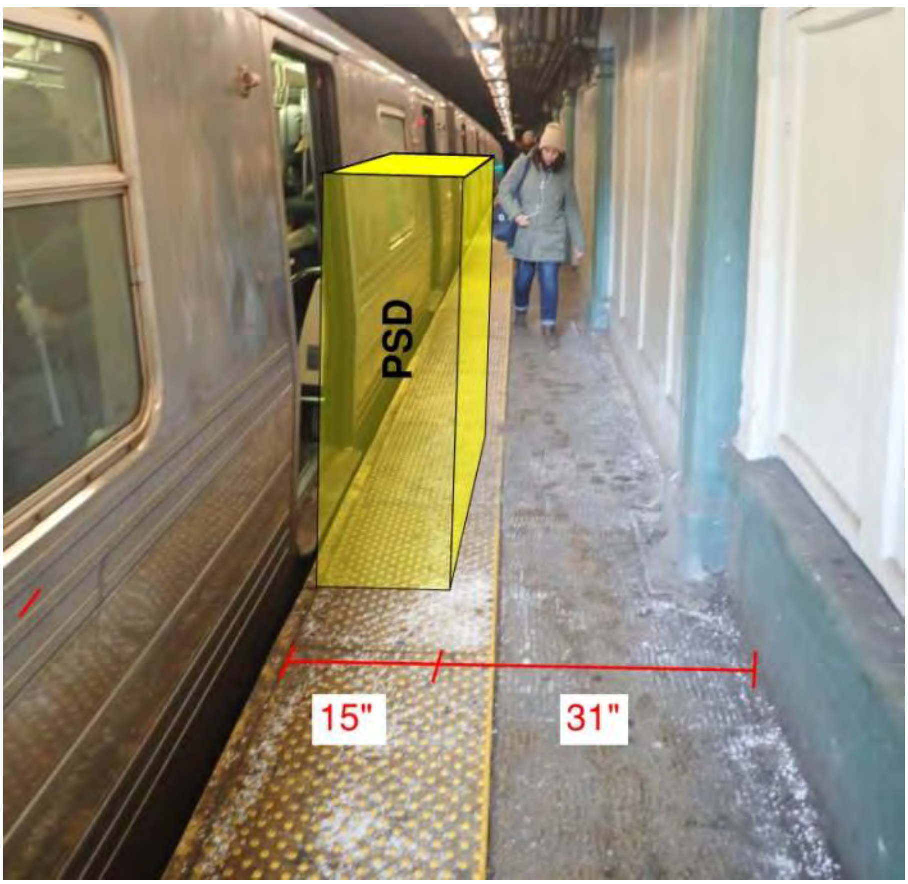

Figure 1 *– Non-compliant ADA condition*
Prospect Park Station

1.15 – MR 043 | Parkside Avenue Station

Summary: *Parkside Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 23" (see figure 1).*

Description

The Parkside Avenue Station is an open cut station with two curved side platforms. The platform structures are cast-in-place concrete. The corridor width at the platform staircases is 3'-2". The implementation of a platform edge barrier would reduce this width below the required minimum corridor width of 36". The remaining 23" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Area of ADA non-compliance*
Parkside Avenue Station

1.16 – MR 044 | Church Avenue Station

Summary: *Church Avenue Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 15" (see figure 1).*

Description

The Church Avenue Station is an open cut station with two straight center / island platforms. The platform structures are cast-in-place concrete. The corridor width adjacent to the station department room is 2'-6". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 15" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement.. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Area of ADA non-compliance*
Church Avenue Station

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1.17 – MR 045 | Beverly Road Station

Summary: *Beverly Road Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 13" (see figure 1).*

Description

The Beverly Road Station is an open cut station with two curved side platforms. The platform structures are cast-in-place concrete. The columns at the platform stairs are 2'-4" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum pinch point width of 32". The remaining 13" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Area of ADA non-compliance*
Beverly Road Station

1.18 – MR 046 | Cortelyou Road Station

Summary: *Cortelyou Road Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 21" (see figure 1).*

Description

The Cortelyou Road Station is an open cut station with two straight side platforms. The platform structures are cast-in-place concrete. The corridor width at the north end of the southbound platform is 3'-0". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 21" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Area of ADA non-compliance*
Cortelyou Road Station

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1.19 – MR 047 | Newkirk Plaza Station

Summary: *Newkirk Plaza Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 13" (see figure 1).*

Description

The Newkirk Plaza Station is an open cut station with two straight center / island platforms. The platform structures are cast-in-place concrete. The pinch point width at platform columns at staircases is 2'-4". The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 13" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

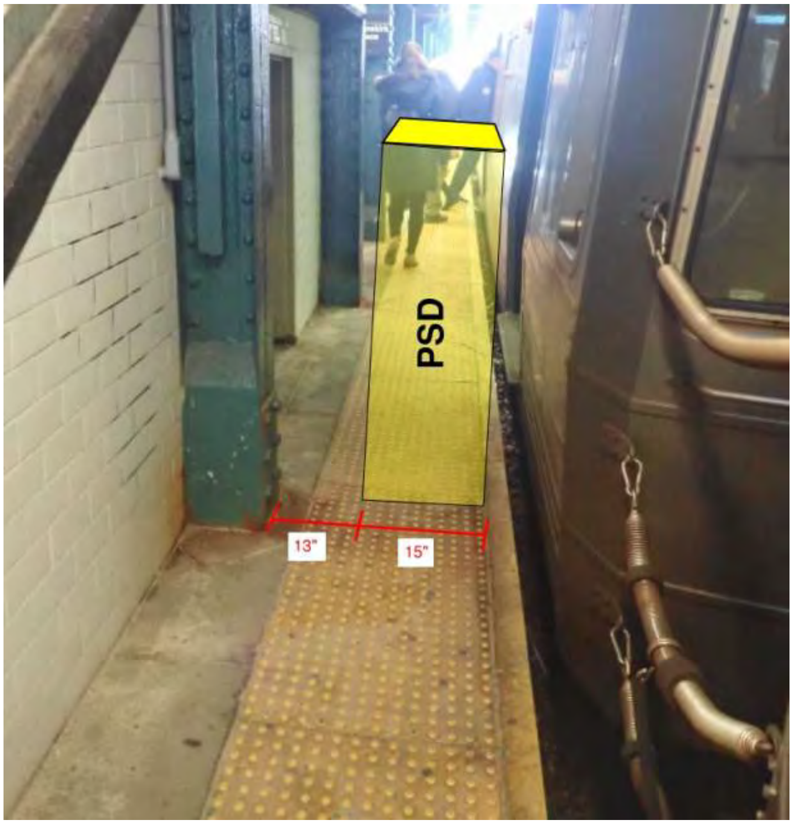

***Figure 1 –** Area of ADA non-compliance*
Newkirk Plaza Station

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1.20 – MR 048 | Avenue H Station

Summary: *Avenue H Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the southbound platform as the existing width is 5'-8" (see figure 1).*

Description

Avenue H Station is an embankment station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 4'-6' to 8'-2". The southbound platform in photo below, is 5'-8" in width. Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

***Figure 1** – Non-Compliant egress condition*
Avenue H Station

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1.21 – MR 049 | Avenue J Station

Summary: *Avenue J Station is feasible for APGs only. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Avenue J Station is an embankment station with two straight side platforms (**see Figure 1**). The platform structures are cast-in-place concrete. A canopy covers approximately one half of the platform length. The platforms are almost entirely column-free. The platform widths range from 6'-6" to 7-8" throughout. Ceiling heights at the canopy measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs are infeasible at outdoor stations outside of the canopy area, as they do not have a structure to support the top of the barriers.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the south end of the southbound platform (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

This platform edge was re-constructed within the last thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

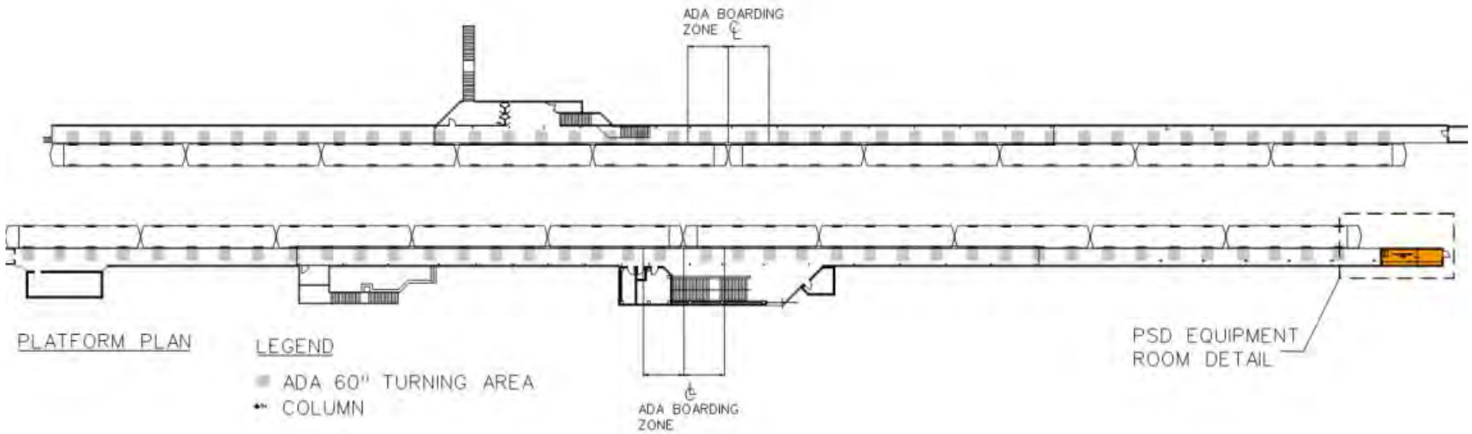

***Figure 1** – Overall Station Plan*
Avenue J Station

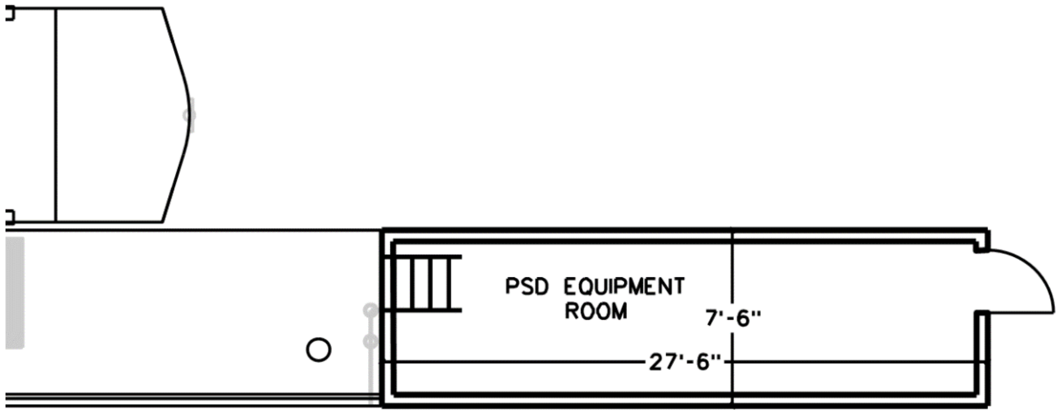

***Figure 2** – PSD Equipment Room Detail*
Avenue J Station

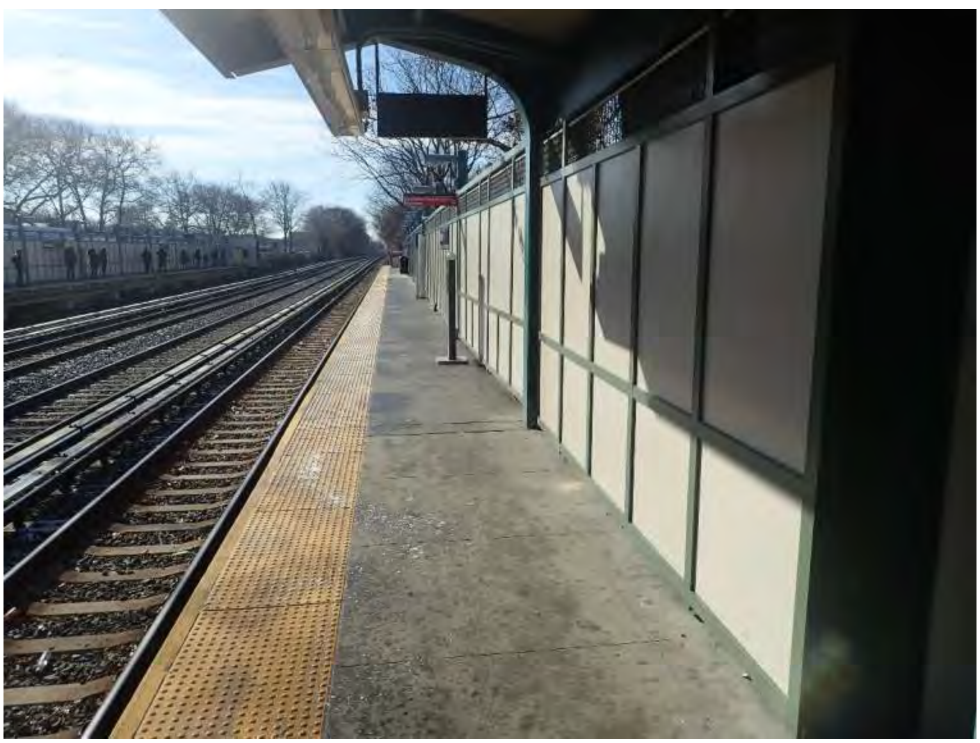

***Figure 3** – Typical platform view*
Avenue J Station

Platform obstructions within 5' of edge:

- None

Lighting:

Existing lighting: Throughout both platform canopy areas there are linear florescent fixtures mounted parallel to the platform edge. Outside of the canopy areas there are point source lights mounted on the windscreens. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 & 2 see the Power Capacity Analysis for this station.

Station

Power Capacity Analysis (Normal service)

Station Name	Avenue J
Peak Demand Load from ConEd Report, (kW)	44.0
Apparent Power (kVA)	55.0
Station Peak Demand Load, Max Current, (A)	155.8
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	350.4
Station Service Power Capacity, (A)	400.0
Service Spare Capacity, (A)	49.6
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey and 1 line diagram, having 400 A Service switch & Fuse. Station has (2) separate meter readings for each Normal & Reserve service. Note that the Con Ed demand data Meter readings are REVERSED. (Reserved reading indicated is actually for Normal.)

***Table 1**. Normal Service Power Capacity Analysis*

Station
Power Capacity Analysis (Reserve service)

Station Name	Avenue J
Peak Demand Load from ConEd Report, (kW)	14.4
Apparent Power (kVA)	18.0
Station Peak Demand Load, Max Current, (A)	50.0
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	245
Station Service Power Capacity, (A)	400
Service Spare Capacity, (A)	155
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey and 1 line diagram, having 400 A Service switch and fuse. Station has (2) separate meter readings for each Normal & Reserve service. Note that the Con Ed demand data Meter readings are REVERSED. (Normal reading indicated is actually for Reserved.)

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.6M to install APGs. (See Appendix E)

1.22 – MR 050 | Avenue M

Summary: *Avenue M Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the north end of the northbound platform as the existing width is 4'-3" (see figure 1).*

Description

Avenue M Station is an embankment station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 4'-3' to 6'-8". The northbound platform in photo below, is 4'-3" in width. Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

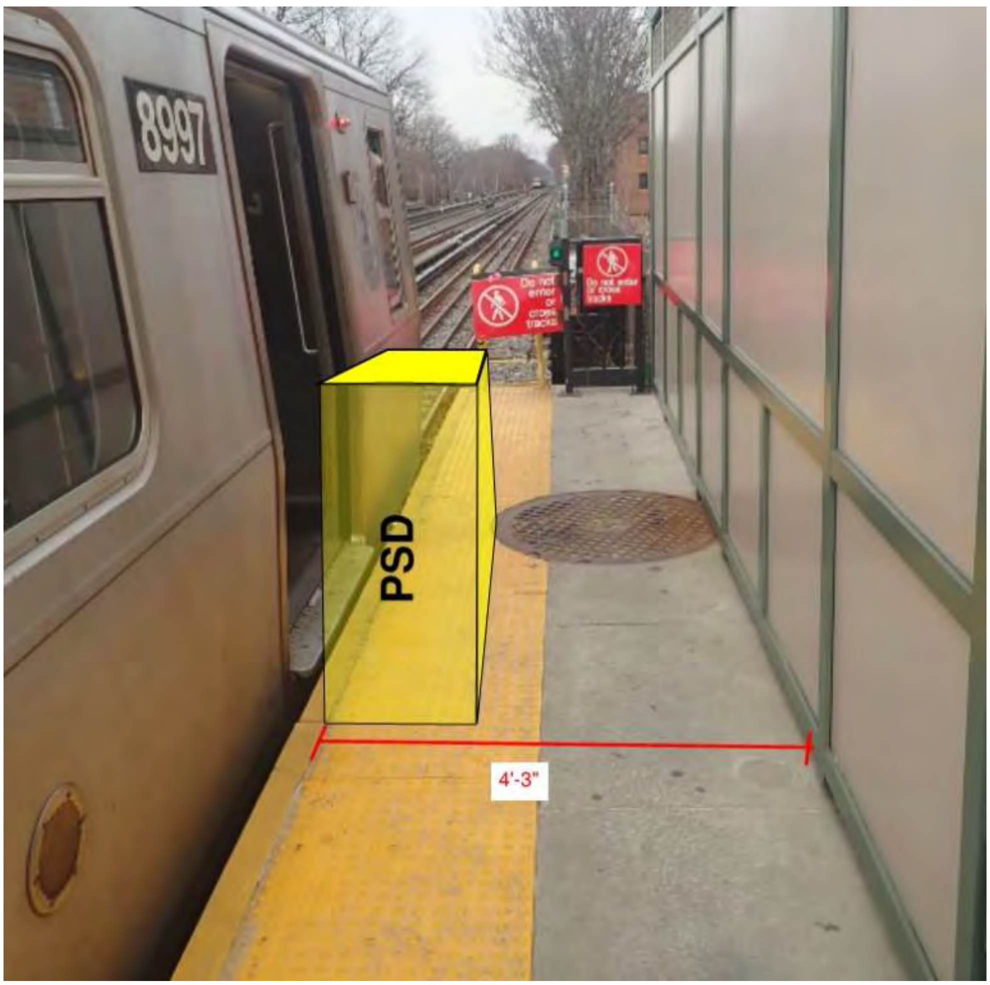

***Figure 1** – Non-Compliant egress condition*
Avenue M Station

1.23 – MR 051 | Kings Highway Station

Summary: *Kings Highway Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 23" (see figure 1).*

Description

The Kings Highway Station is an embankment station with two straight center / island platforms. The platform structures are cast-in-place concrete. The width of the platforms is approximately 15'-0". At the elevator, the clearance is 3'-2". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 23" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Area of ADA non-compliance*
Kings Highway Station

1.24 – MR 052 | Avenue U Station

Summary: *Avenue U Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 29" (see figure 1).*

Description

The Avenue U Station is an embankment station with two straight side platforms. The platform structures are cast-in-place concrete. The platform widths range from 3'-8" to 11'-6". The south end of the northbound platform is 3'-8" in width. The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 29" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

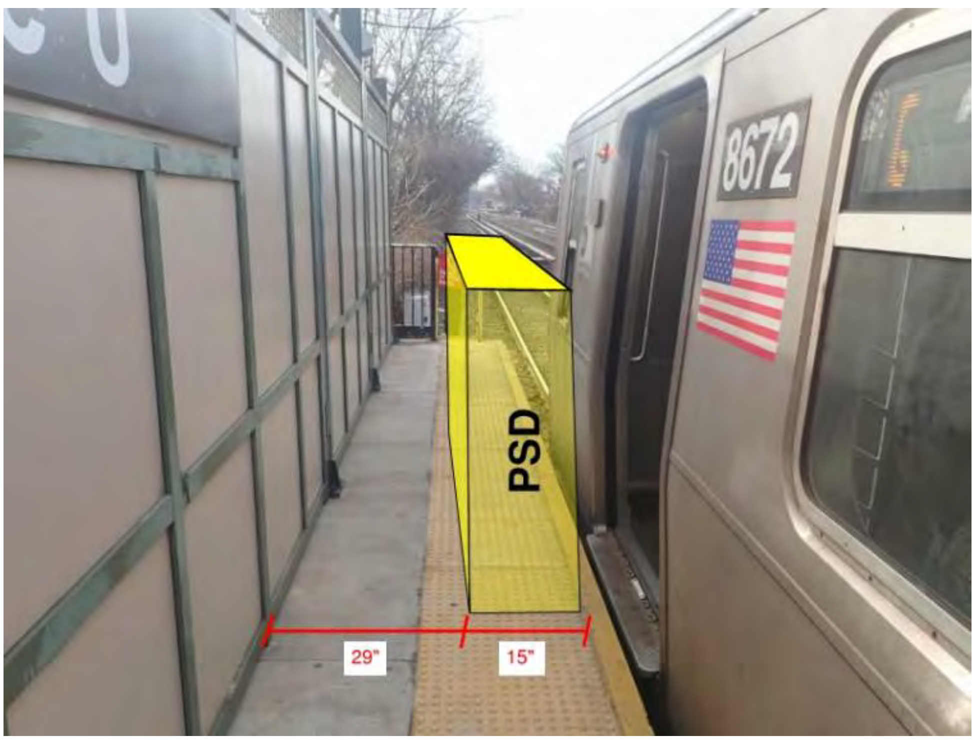

***Figure 1 –** Area of ADA non-compliance*
Avenue U Station

1.25 – MR 053 | Neck Road

Summary: *Neck Road Station is feasible for APGs only. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Neck Road Station is an embankment station with two straight side platforms (see Figure 1). The platform structures are cast-in-place concrete. The platforms are almost entirely column-free. A canopy covers approximately one third of the platform length. The platform widths range from 6'-8" to 7-0" throughout. Ceiling heights measure no less than 7'-6" in the canopy area.

Full Height PSDs: Full height PSDs are infeasible at outdoor stations outside of the canopy area, as they do not have a structure to support the top of the barriers.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the south end of the southbound platform (**see Figure 1, Figure 2**). The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

This platform edge was re-constructed within the last thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'Q' Line Stations
(Neck Road Station)

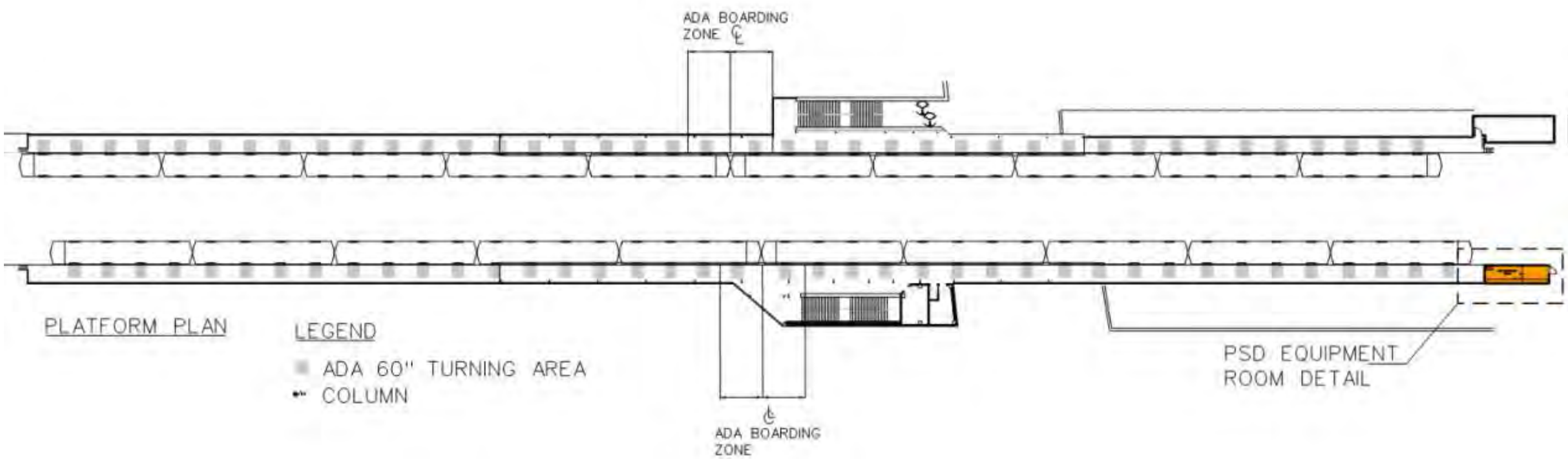

***Figure 1** – Overall Station Plan*
Neck Road Station

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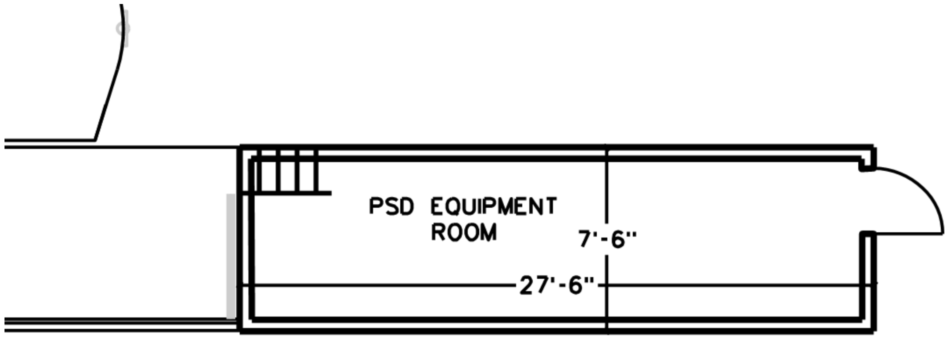

Figure 2 *– PSD Equipment Room Detail*
Neck Road Station

Figure 3 *– Typical platform view*
Neck Road Station

Platform obstructions within 5' of edge:

- None

Lighting:

Existing lighting: Throughout both platform canopy areas there are linear florescent fixtures mounted parallel to the platform edge. Outside of the canopy areas there are point source lights mounted on the windscreens. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate electrical capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 & 2 see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis (Normal service)

Station Name	Neck Road
Peak Demand Load from ConEd Report, (kW)	4302.0
Apparent Power (kVA)	54.0
Station Peak Demand Load, Max Current, (A)	150.0
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	344.6
Station Service Power Capacity, (A)	400.0
Service Spare Capacity, (A)	55.4
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey and 1 line diagram, having 400 A Service switch & Fuse. Station has (2) separate meter readings for each Normal & Reserve service.

Table 1. Normal Service Power Capacity Analysis

Station
Power Capacity Analysis (Reserve service)

Station Name	Neck Road
Peak Demand Load from ConEd Report, (kW)	12.8
Apparent Power (kVA)	16.0
Station Peak Demand Load, Max Current, (A)	44.4
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	239
Station Service Power Capacity, (A)	400
Service Spare Capacity, (A)	161
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on field survey and 1 line diagram, having 400 A Service switch and fuse. Station has (2) separate meter readings for each Normal & Reserve service.

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.5M to install APGs. (See Appendix E)

1.26 – MR 054 | Sheepshead Bay Station

Summary: *Sheepshead Bay Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 29" (see figure 1).*

Description

The Sheepshead Bay Station is an elevated station with two curved center / island platforms. The platform structures are cast-in-place concrete. The platform widths are approximately 15'-6". At the stairs, the clearance is 3'-8". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 29" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Area of ADA non-compliance*
Sheepshead Bay Station

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1.27 – MR 055 | Brighton Beach Station

Summary: *Brighton Beach Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 29" (see figure 1).*

Description

The Brighton Beach Station is an elevated station with two curved center / island platforms. The platform structures are cast-in-place concrete. The platforms are approximately 15'-6" in width. At the four stairways, the clearance is 3'-8" from edge of platform. The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 29" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

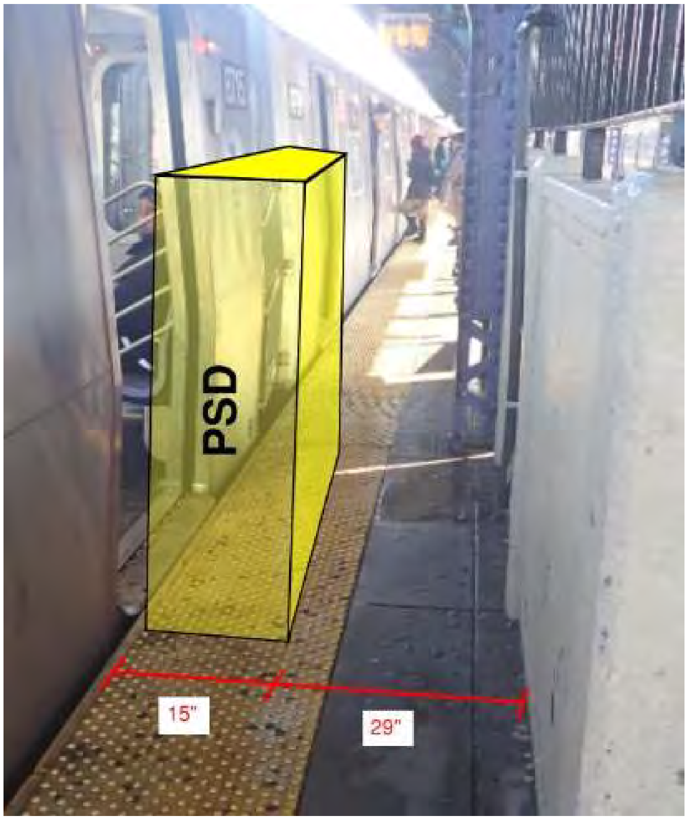

Figure 1 – *Area of ADA non-compliance*
Brighton Beach Station

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1.28 – MR 056 | Ocean Parkway Station

Summary: *Ocean Parkway Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 23" (see figure 1).*

Description

The Ocean Parkway Station is an elevated station with two curved center / island platforms. The platform structures are cast-in-place concrete. The platforms are approximately 15'-0" in width. At stairway p-2, there is clearance of 3'-2" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 23" or less* would not allow for ADA compliant wheelchair movement. The other three stairways are similar. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Area of ADA non-compliance*
Ocean Parkway Station

1.29 - MR-057 | West 8th Street Station

Summary: *West 8th Street Station (MR-57) is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 17" (see figure 1).*

Description

West 8th Street Station is an elevated station with slightly curved side platforms that serve the 'F' and 'Q' trains. The lower platform level serves the 'F' line and the upper platform serves the 'Q' line (lower level is the subject of a separate report for the F service). The platform structure is cast-in-place concrete. The width of the platform varies from 5'-2" to 12'-10". At the escalator machine room, adjacent columns are 2'-8" from the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 17" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. Two of the stairways are similar. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

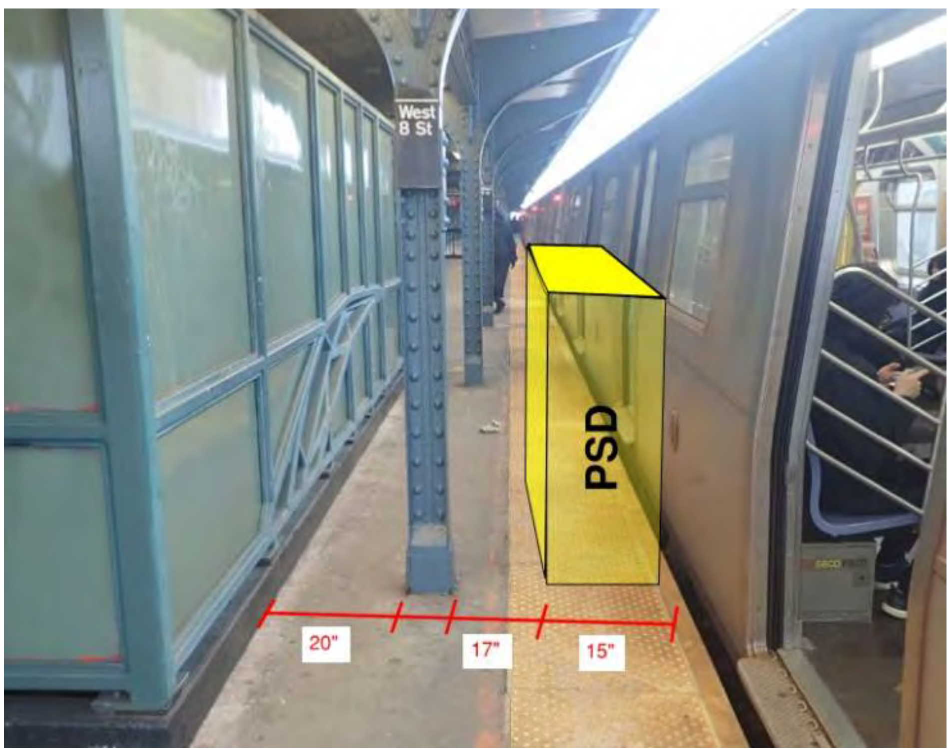

Figure 1 – Non-compliant ADA condition on the Manhattan-bound platform- West 8th St-NY Aquarium

1.30 – MR 058 Coney Island-Stillwell Avenue Station

Summary: *Coney Island-Stillwell Avenue Station is feasible for both APGs and PSDs. This station is the terminus station for the 'N', 'Q', 'D', and 'F' trains. Tracks 3 and 4 serve the Q line from a shared center / island platform. The canopy at this station is very tall, and there are no structural members directly above the platform edge. For the installation of a full height PSD system, structural members would have to be attached to existing beams that are approximately 12'-0" high and 5'-0" from the platform edge. One and a half train cars are not covered by a canopy. Therefore, a supplemental overhead structure would be needed in this part of the platform. Platform edge reconstruction will be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Coney Island-Stillwell Avenue Station is an elevated station with four center / island platforms. The 'Q' line platform is straight. The platform structure is made of cast-in-place concrete. There are two stairs and a centrally located ramp that provide access to the mezzanine level below. There are two rows of columns along the length of the platform. These columns are spaced approximately 20'-0" on center with column faces 6'-10" from the platform edge. The platform is 26'-0" in width. One and a half train cars are not covered by the canopy. A supplementary overhead structure would be required in these locations to accommodate a platform edge barrier. See figure 1 for an overall station plan.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the adjacent structure as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. As indicated in the summary, there is no structure to mount to directly above the platform edge, requiring that some additional framing be constructed to hold the top of the PSDs. (see figure 3).

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, entrapment prevention sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be CCTV cameras over each motorized sliding door which will need to be in coordination with existing or replacement lighting. Minimal overhead structure would be needed to accommodate cameras and sensors in the small portion of the platforms not covered by canopies

Equipment Room

One room can be accommodated on the platform between columns at the center of the platform. The proposed room would measure approximately 16'-0" x 12'-0" (see figure 2). The other lines that are served at this station could use a similar room location on their respective platform (see figure 1)

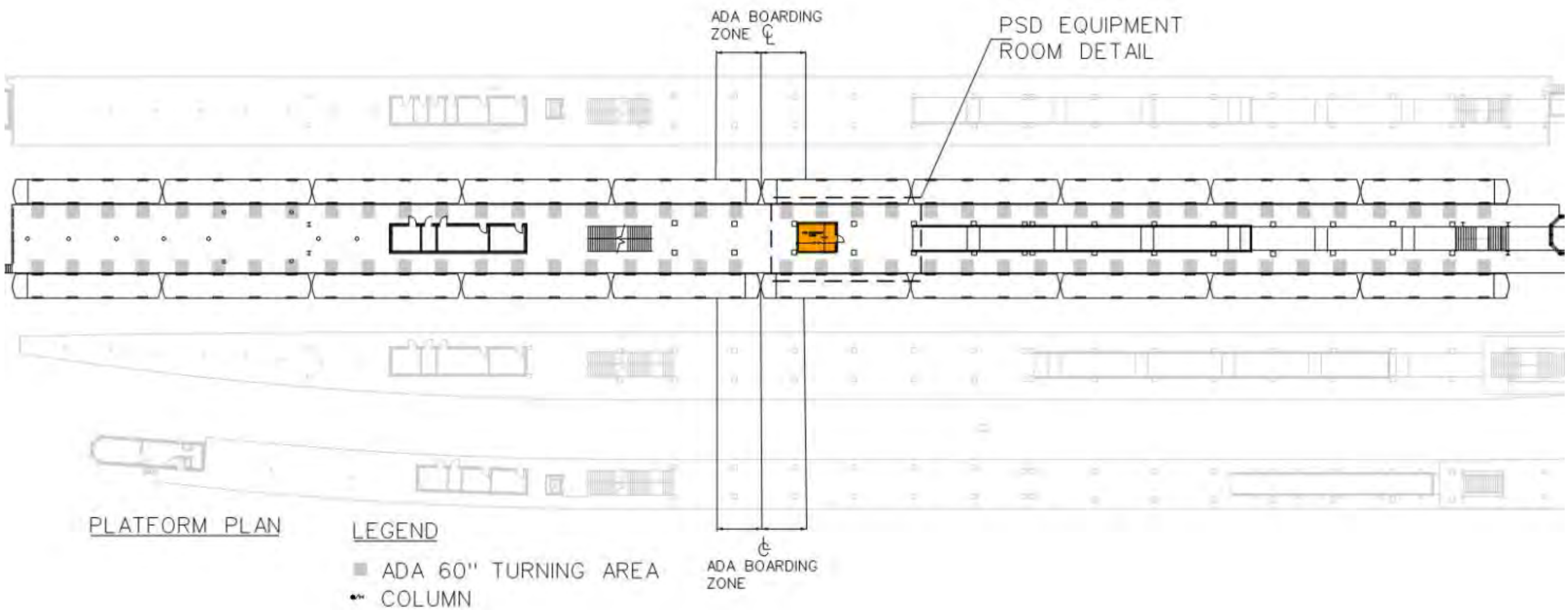

***Figure 1** – Station Plan*
Coney Island-Stillwell Avenue Station

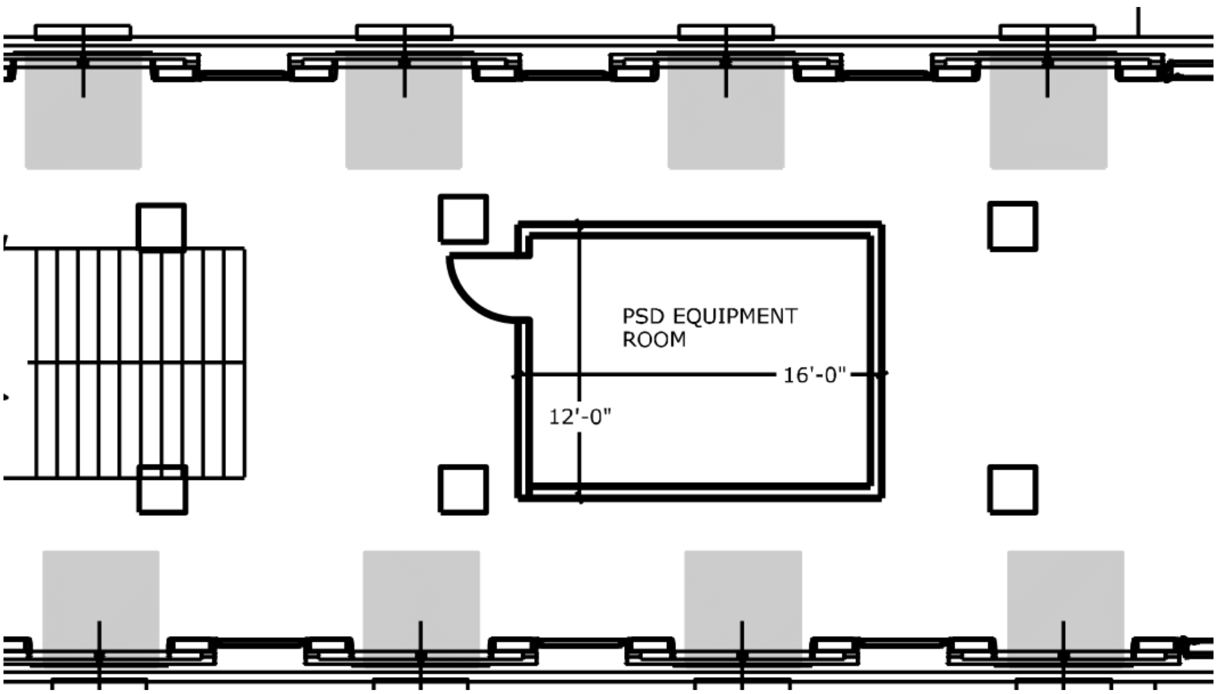

***Figure 2** – PSD Equipment Room Detail*
Coney Island-Stillwell Avenue Station

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform edge condition

The platform edges were reconstructed in 2004. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

Platform obstructions within 5' of edge:

None.

Lighting:

Existing lighting: Linear fluorescent lights are mounted below the beams that run parallel to the platform. These beams are approximately 12'-0" high and 5'-0" from the edge of the platform. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

The existing Reserve electrical service is adequate for the installation of PSD/APG's. However, the Normal service is not adequate and therefore would not serve as a back-up system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 and Table 2 please see the Power Capacity Analysis for this station.

Station (Normal)
Power Capacity Analysis

Station Name	Coney Island Stillwell
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	552.0
Apparent Power (kVA)	690.0
Station Peak Demand Load, Max Current, (A)	1916.7
Maximum Amount of Doors	320.0
PSD Total Load Including All Miscellaneous Loads, (A)	632.6
Total Load (Station Peak + PSD), (A)	2549
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	0
Is Electrical Service Adequate?	**No**
Notes	This is for Normal service only. Station has (2) separate meter readings (not combined). Normal service has exceeded its service rating. **NO** additional load can be connected to this normal service.

Table 1. Power Capacity Analysis (Normal Service)

Station (Reserve)
Power Capacity Analysis

Station Name	Coney Island Stillwell
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	112.0
Apparent Power (kVA)	140.0
Station Peak Demand Load, Max Current, (A)	388.9
Maximum Amount of Doors	320.0
PSD Total Load Including All Miscellaneous Loads, (A)	632.6
Total Load (Station Peak + PSD), (A)	1022
Station Service Power Capacity, (Main SB or SG Rating), (A)	1200
Service Spare Capacity, (A)	179
Is Electrical Service Adequate?	Yes
Notes	This is for Reserve service only. This is based on assumption that each Service is separate. Reserve service has spare capacity. (Normal service has **NO** spare capacity)

Table 2. Power Capacity Analysis (Reserve Service)

Historic Restrictions:
None.

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.0M to install APGs and $40.0M to install PSDs (See Appendix E).

***Figure 3** – Typical platform edge condition with line of potential supplementary framing*
Coney Island-Stillwell Avenue Station

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1.31 - MR-223 | Lexington Avenue-63rd Street Station

Summary: *Lexington Avenue-63rd Street Station (MR-223) is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power capacity could not be ascertained due to inaccessibility during survey. However, a lack of adequate existing power is not considered to be a determining factor of future feasibility.*

Description

Lexington Avenue- 63rd Street Station is a below-grade station with two straight center / island platforms (see figure 1). The platforms are stacked; the upper level provides Coney Island-bound service, while the lower level provides 96th Street-bound service. The platform structure is cast-in-place concrete. At the middle of both platforms there are six columns in two rows spaced 8'-0" apart with column faces 4'-6" from the edge of the platform. In addition to these columns, the lower level has a row of columns centered on the platform width spaced 15'-0" on center.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Due to the treatment of the ceilings at and beyond the platform edge, modification of metal panels may be necessary to create the supporting structure of a full height system. Additionally, relocation of police radio antenna may be required.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

This station will need two equipment rooms as there are four platform edges. For the two Q-line platform edges, one room can be located in the middle of the upper level platform between the existing columns. The proposed room dimension is 12'-0" x 16'-0" (see figure 2).

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'Q' Line Stations
(Lexington Avenue-63rd Street Station)

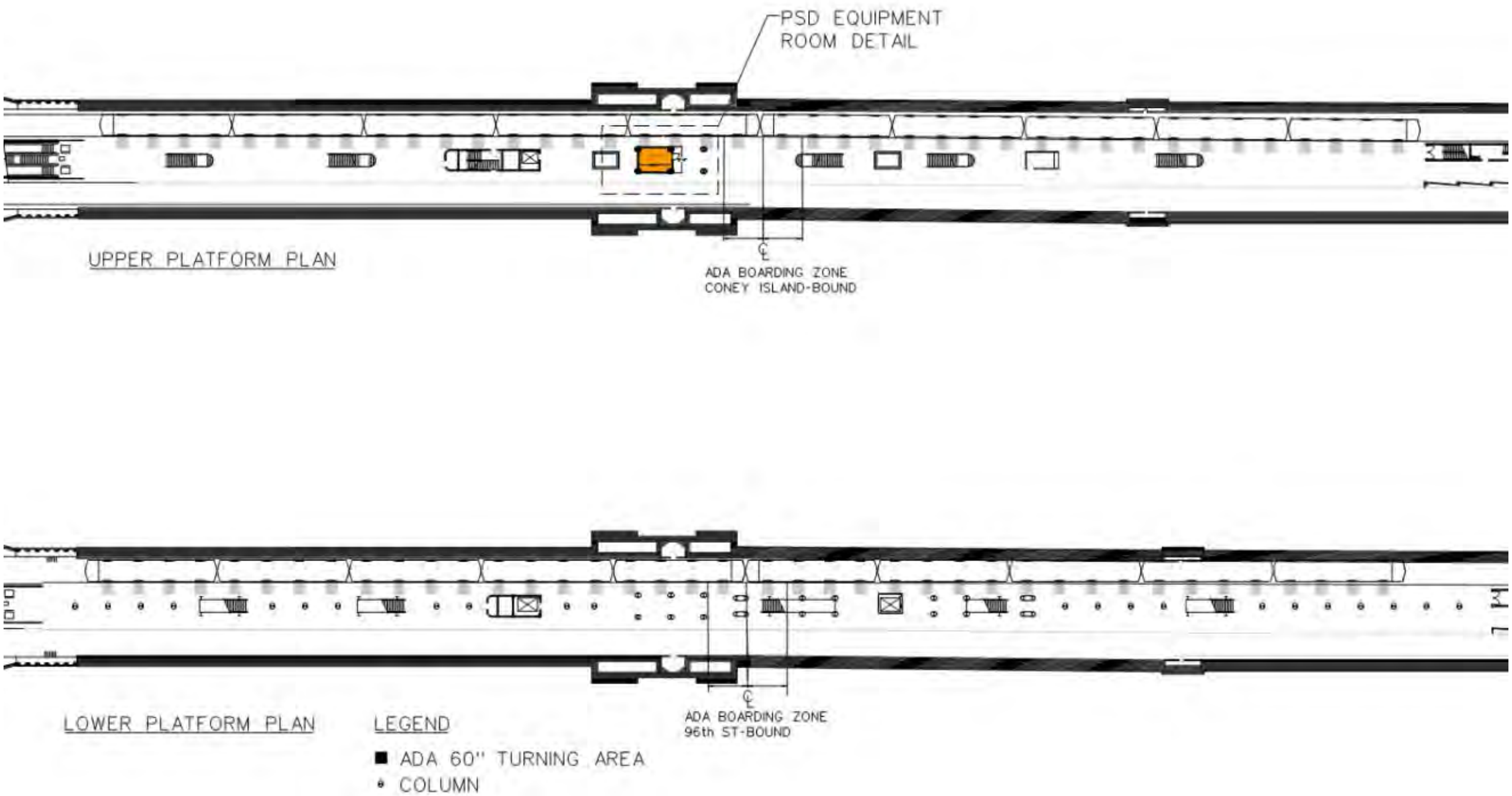

Figure 1 – Station Plan- Lexington Ave.-63rd St. Station

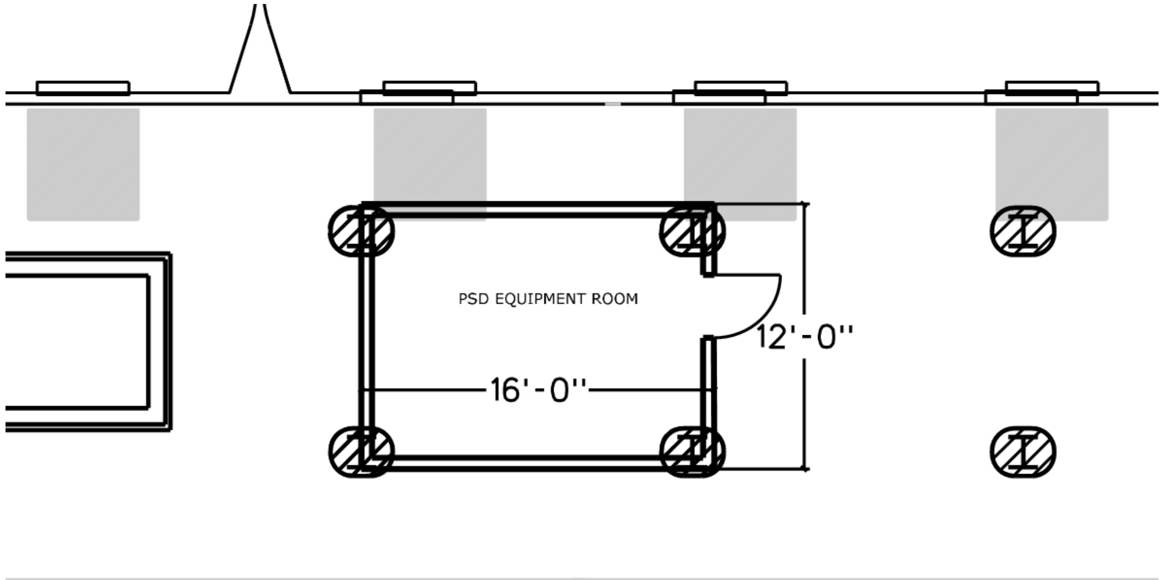

Figure 2 – PSD Equipment Room Detail – Lexington Ave.-63rd St. Station

Platform Edge Condition

This platform edge was re-constructed within the last thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

Platform obstructions within 5' of edge:

- Coney Island-bound: There are three columns that are 4'-6" away from the platform edge.
- 96th Street-bound: There are three columns that are 4'-6" away from the platform edge.

These obstructions do not present an impediment to the installation of PSDs.

Lighting:

Existing lighting: Lighting fixtures are fluorescent tubes recessed above removable ceiling panels, and encased fluorescent tubes installed approximately 60" away from the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This information was not ascertainable at the time of the survey. However, we do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.6M to install APGs and $39.2M to install PSDs (See Appendix E)

Figure 3 – Platform edge condition on the upper level (Coney Island-bound)- Lexington Ave.-63rd St. Station

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Figure 4 –Platform edge condition on the lower level (96th Street-bound)- Lexington Ave.-63rd St. Station

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1.32 – MR 475 | 96th Street

Summary: *96th Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power capacity could not be ascertained due to inaccessibility during survey. However, a lack of adequate existing power is not considered to be a determining factor of future feasibility.*

Description

96th Street Station is a below-grade station with one center / island platform (**see Figure 1)**. This is a newly constructed station completed in 2016.The platform structure is cast-in-place concrete. There are no columns throughout the platform. The platform width is 29'-3" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Due to the treatment of the ceilings at and beyond the platform edge, modification of metal panels may be necessary to create the supporting structure of a full height system. Additionally, relocation of police radio antenna may be required.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the north end of the platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were constructed within the past five years. From our limited visual inspection and our knowledge of structural details of the platform construction, structural work would at a minimum be required for the installation of an APG system.

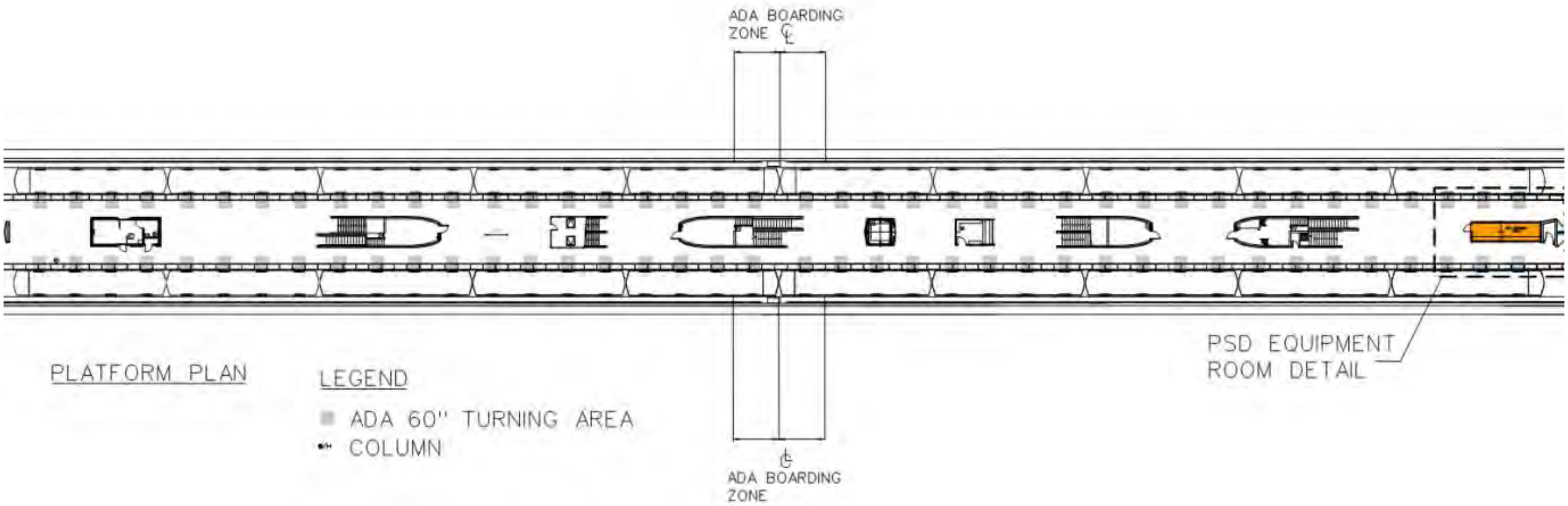

Figure 1 – *Overall Station Plan*
96th Street Station

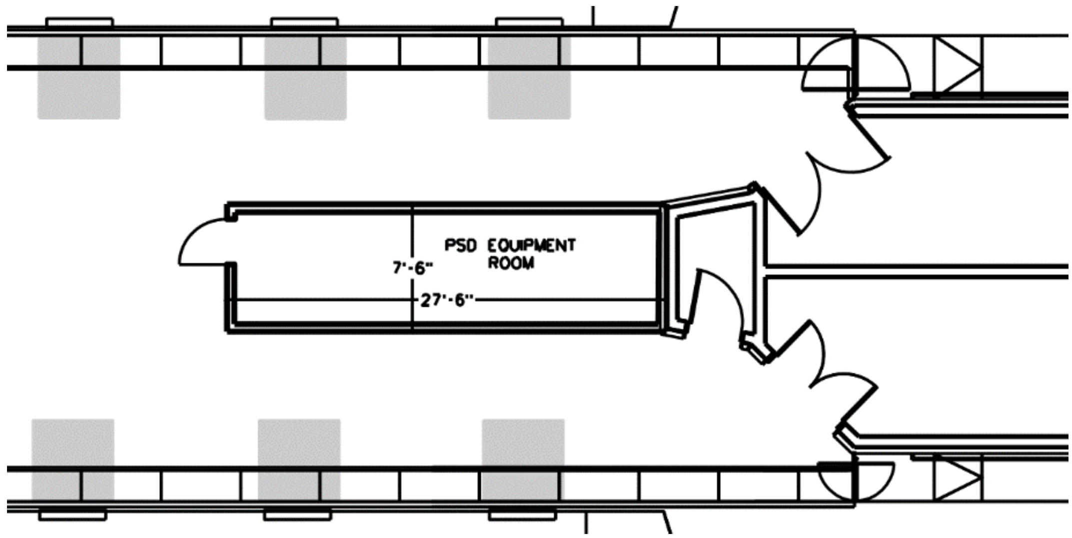

Figure 2 *– PSD Equipment Room Detail*
96th Street Station

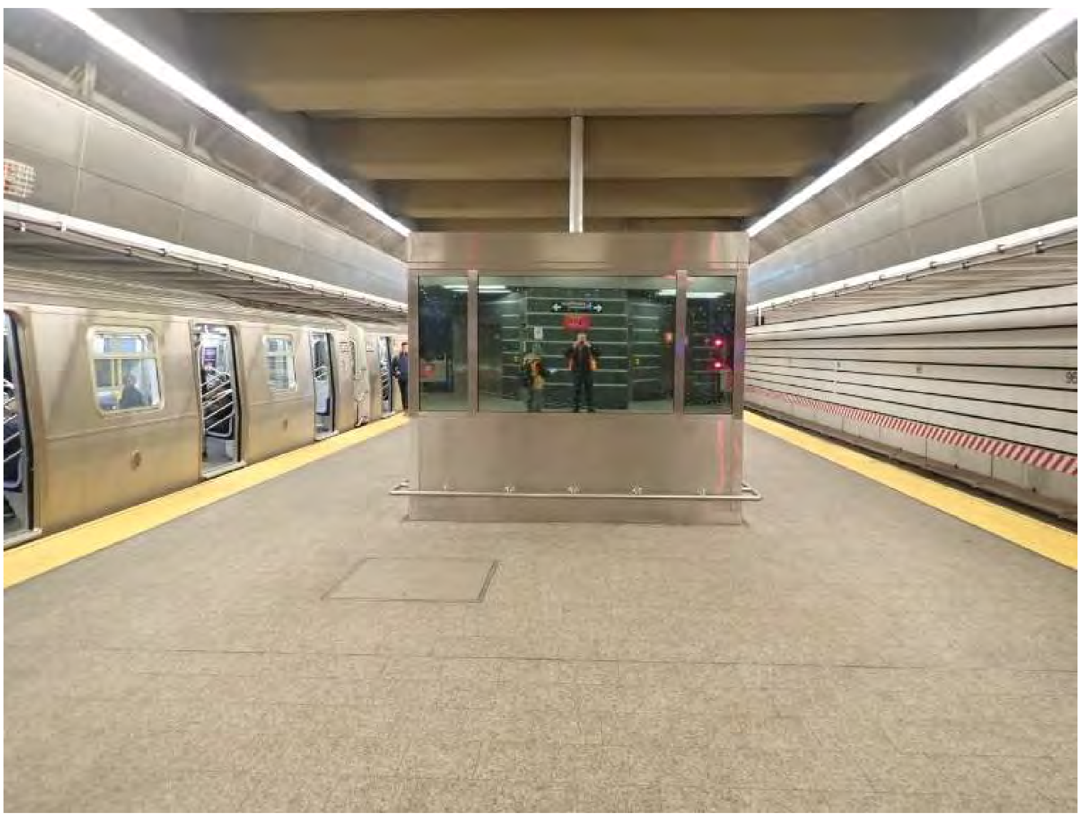

Figure 3 *– Typical platform view*
96th Street Station

Platform obstructions within 5' of edge:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

An analysis of adequate electrical power at this station could not be performed due to inaccessibility during survey. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.2M to install APGs and $39.2M to install PSDs (See Appendix E)

1.33 – MR 476 | 86th Street

Summary: *86th Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power capacity could not be ascertained due to inaccessibility during survey. However, a lack of adequate existing power is not considered to be a determining factor of future feasibility.*

Description

86th Street Station is a below-grade station with one center / island platform (**see Figure 1)**. This is a newly constructed station completed in 2016. The platform structures are cast-in-place concrete. There are no columns on the platform. The platform width is 27'-8" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Due to the treatment of the ceilings at and beyond the platform edge, modification of metal panels may be necessary to create the supporting structure of a full height system. Additionally, relocation of police radio antenna may be required.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the north end of the platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were constructed within the past five years. From our limited visual inspection and our knowledge of structural details of the platform construction, structural work would at a minimum be required for the installation of an APG system.

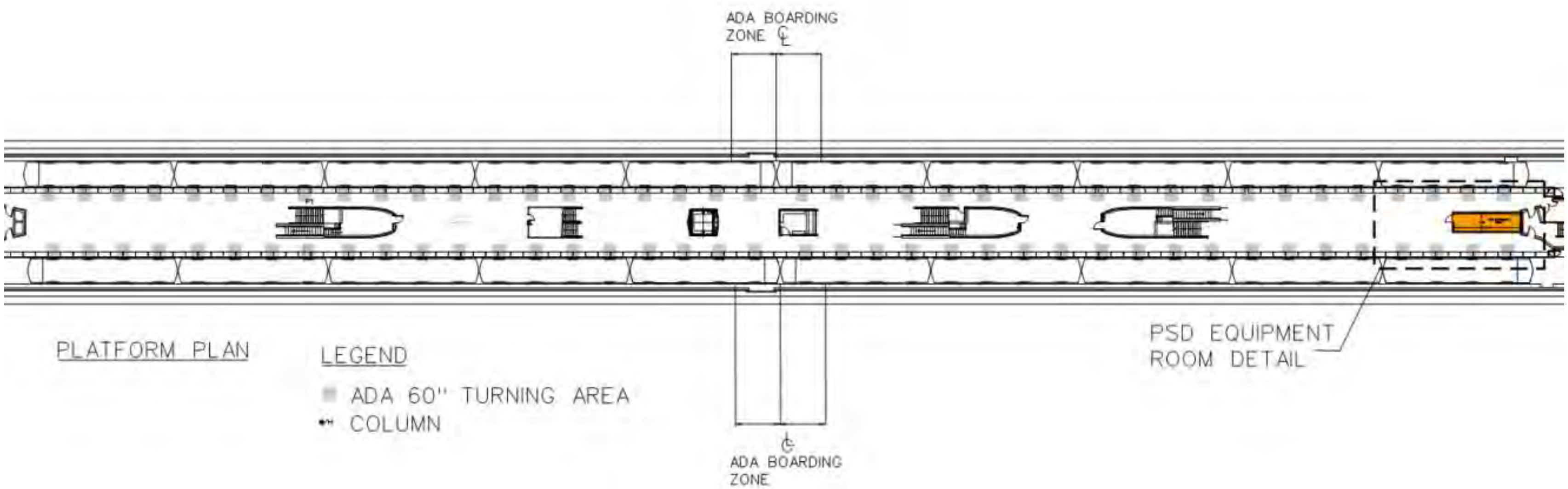

***Figure 1** – Overall Station Plan*
86th Street Station

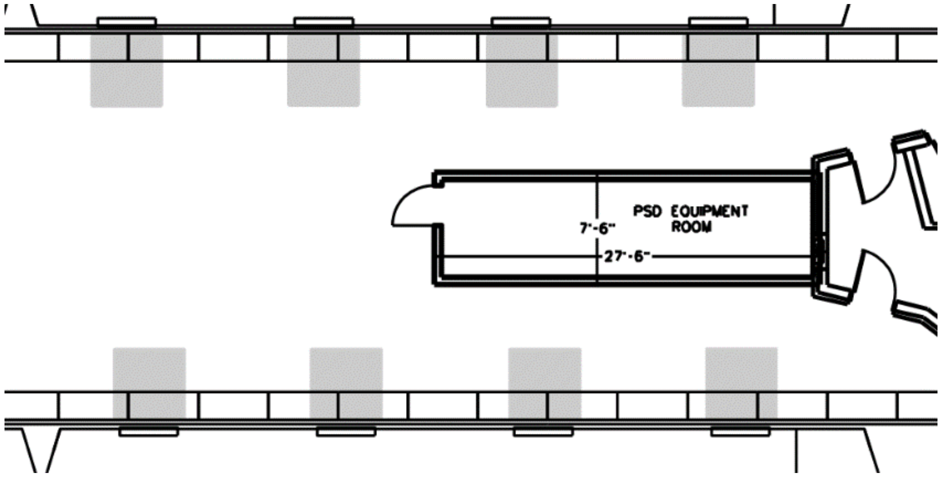

Figure 2 *– PSD Equipment Room Detail*
86th Street Station

Figure 3 *– Typical platform view*
86th Street Station

Platform obstructions within 5' of edge:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:

An analysis of adequate electrical power at this station could not be performed due to inaccessibility during survey. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.4M to install APGs and $39.1M to install PSDs (See Appendix E)

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1.34 – MR 477 | 72nd Street

Summary: *72nd Street Station is feasible for both APGs and PSDs. Platform edge reconstruction may be required to support the requirements of an APG system (see Appendix B). Existing power capacity could not be ascertained due to inaccessibility during survey. However, a lack of adequate existing power is not considered to be a determining factor of future feasibility.*

Description

72nd Street Station is a below-grade station with one center / island platform (**see Figure 1)**. This is a newly constructed station completed in 2016. The platform structure is cast-in-place concrete. There are no columns on the platform. The platform width is 27'-8" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Due to the treatment of the ceilings at and beyond the platform edge, modification of metal panels may be necessary to create the supporting structure of a full height system. Additionally, relocation of police radio antenna may be required.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the north end of the platform (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Therefore we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant from the train doors to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were constructed within the past five years. From our limited visual inspection and our knowledge of structural details of the platform construction, structural work would at a minimum be required for the installation of an APG system.

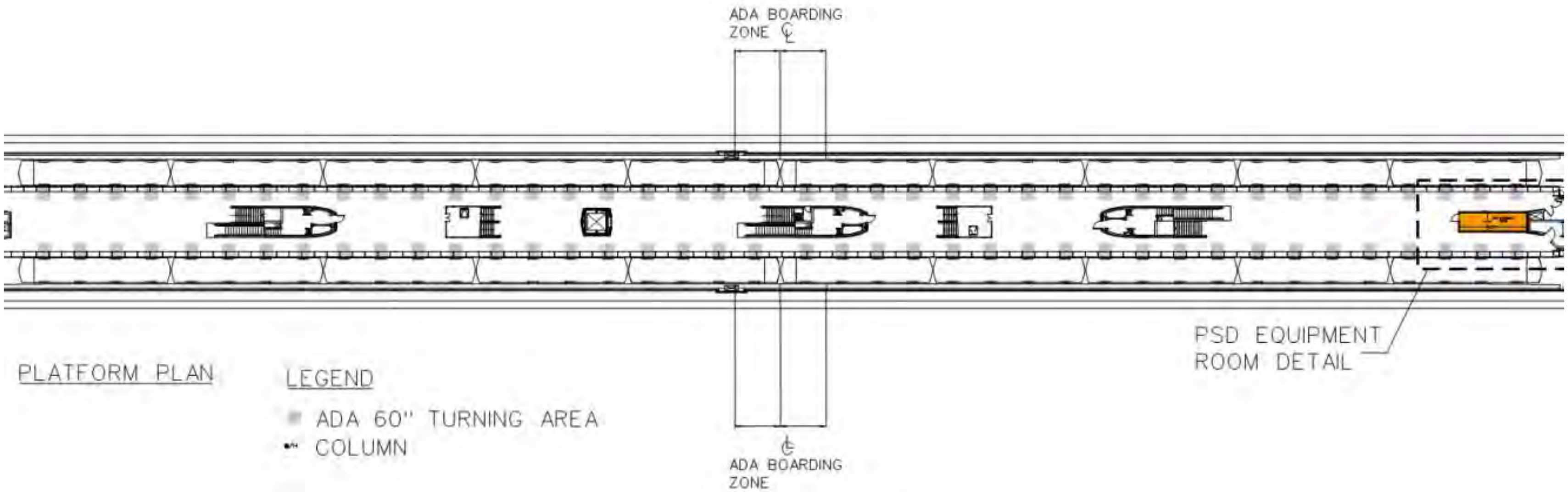

Figure 1 – Overall Station Plan
72nd Street Station

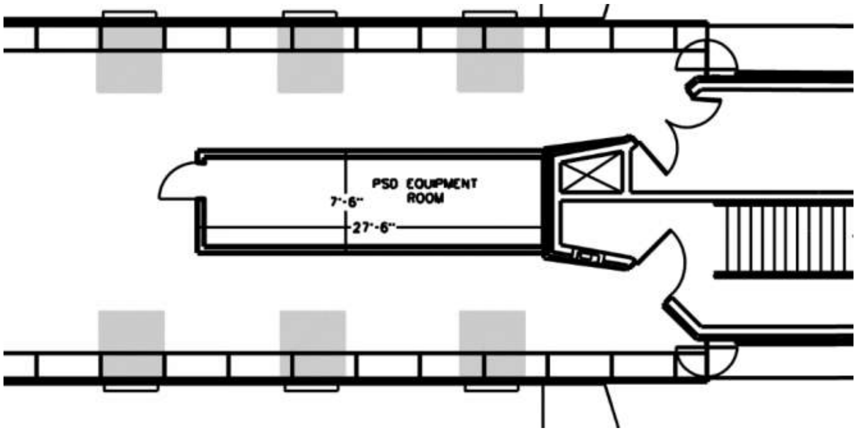

***Figure 2** – PSD Equipment Room Detail*
72nd Street Station

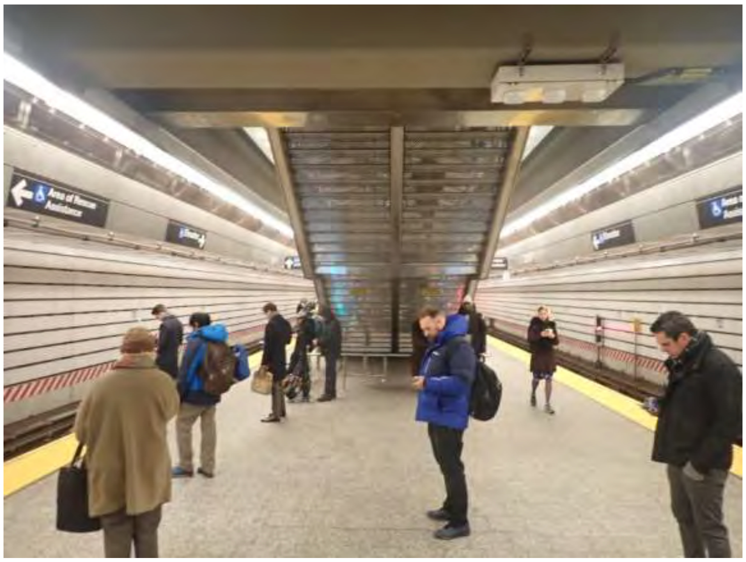

***Figure 3** – Typical platform view*
72nd Street Station

Platform obstructions within 5' of edge:

- None

Lighting:

Existing lighting: Throughout the platform there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration

Power:
An analysis of adequate electrical power at this station could not be performed due to inaccessibility during survey. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.4M to install APGs and $39.3M to install PSDs (See Appendix E).

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Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*
>
> *a. Column location in relation to the platform edge*
> *b. Platform edge clearance adjacent to stairs and other impediments*
> *c. Impacts to ADA path of travel and boarding areas*
> *d. Conflicts of PSD/APG/RPSDs with Signals cables*
> *e. Sufficient platform width*
> *f. Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*
>
> *a. Structural capacity of platforms to accept PSD/APG/RPSDs*
> *b. Feasibility & location for PSD/APG/RPSDs equipment room*
> *c. Confirmation of adequate power for PSD/APG/RPSDs*
> *d. Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> *e. Determination of communications requirements, availability and cost*
> *f. Determination of gap detection and entrapment avoidance technology requirements*
> *g. Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.

k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.

l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
    - Double the amount of motors as PSDs (each motor operating a single leaf).
    - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
    - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
    - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	Comments
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

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If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

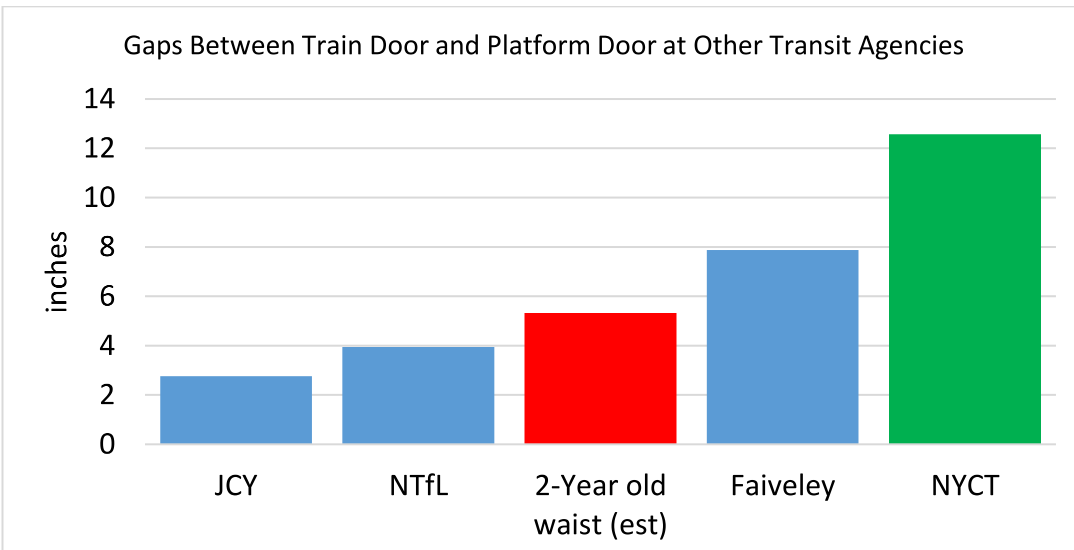


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

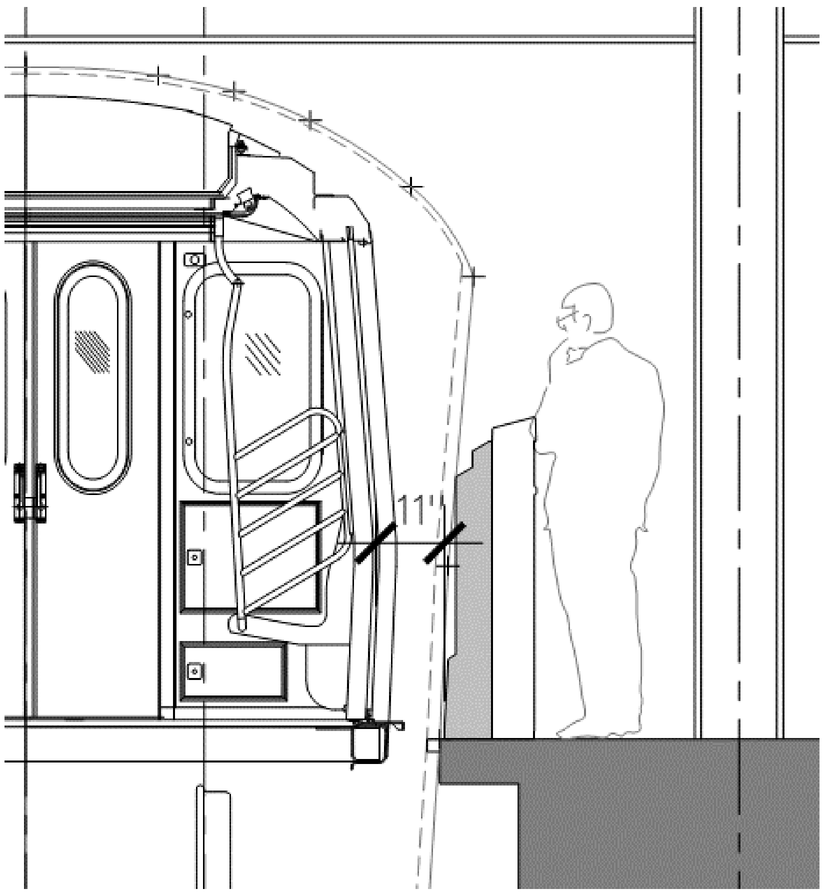


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber “bumpers” on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6” into the line equipment envelope. This would leave a 5” gap between the platform and car doors allowing approximately 2” of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5" by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor's window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor's window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **bold/underline**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	PSD System 1	PSD System 2	PSD System 3
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are “existing” as defined by code. All the rolling stock is also to be considered “existing” under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60” radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36” of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

304 Turning Space

304.1 General. Turning space shall comply with 304.

304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.

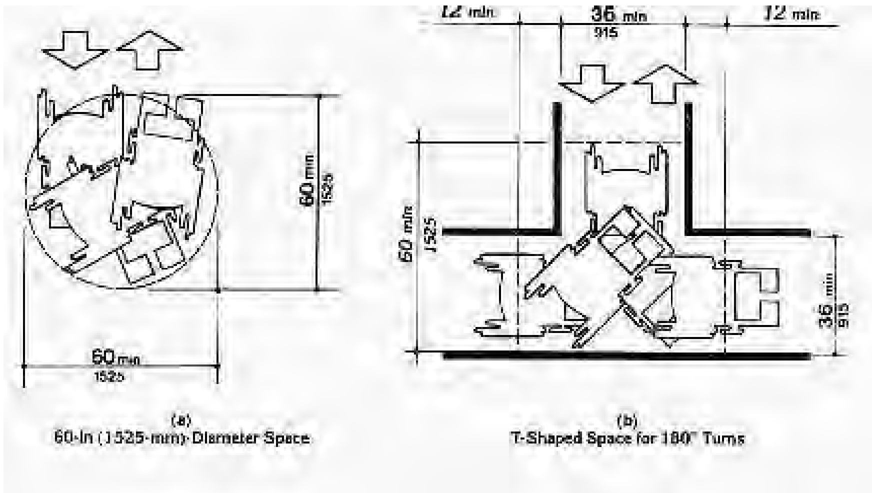
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

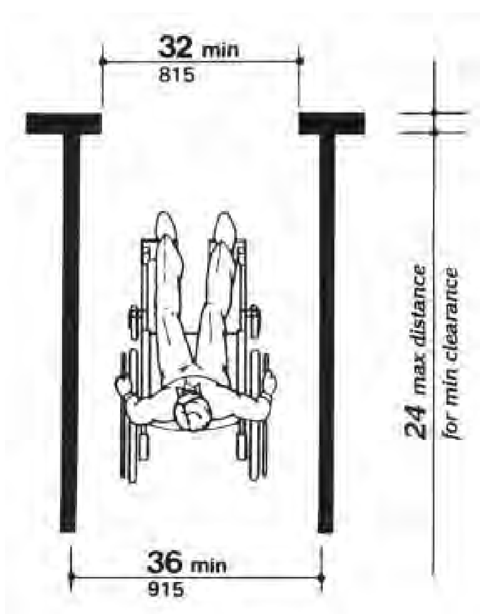


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

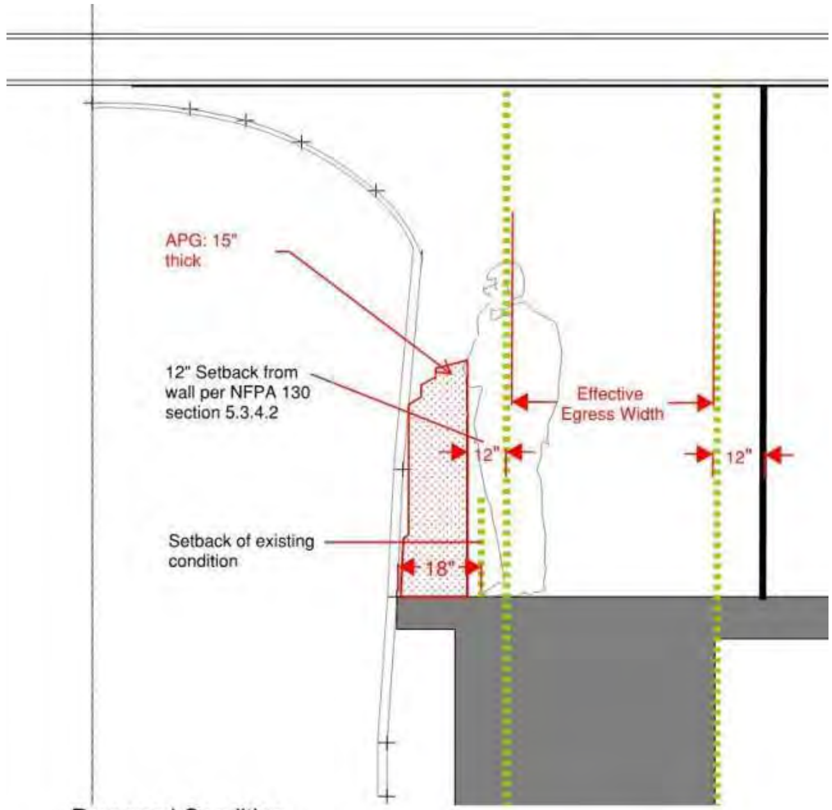
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15" of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

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Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

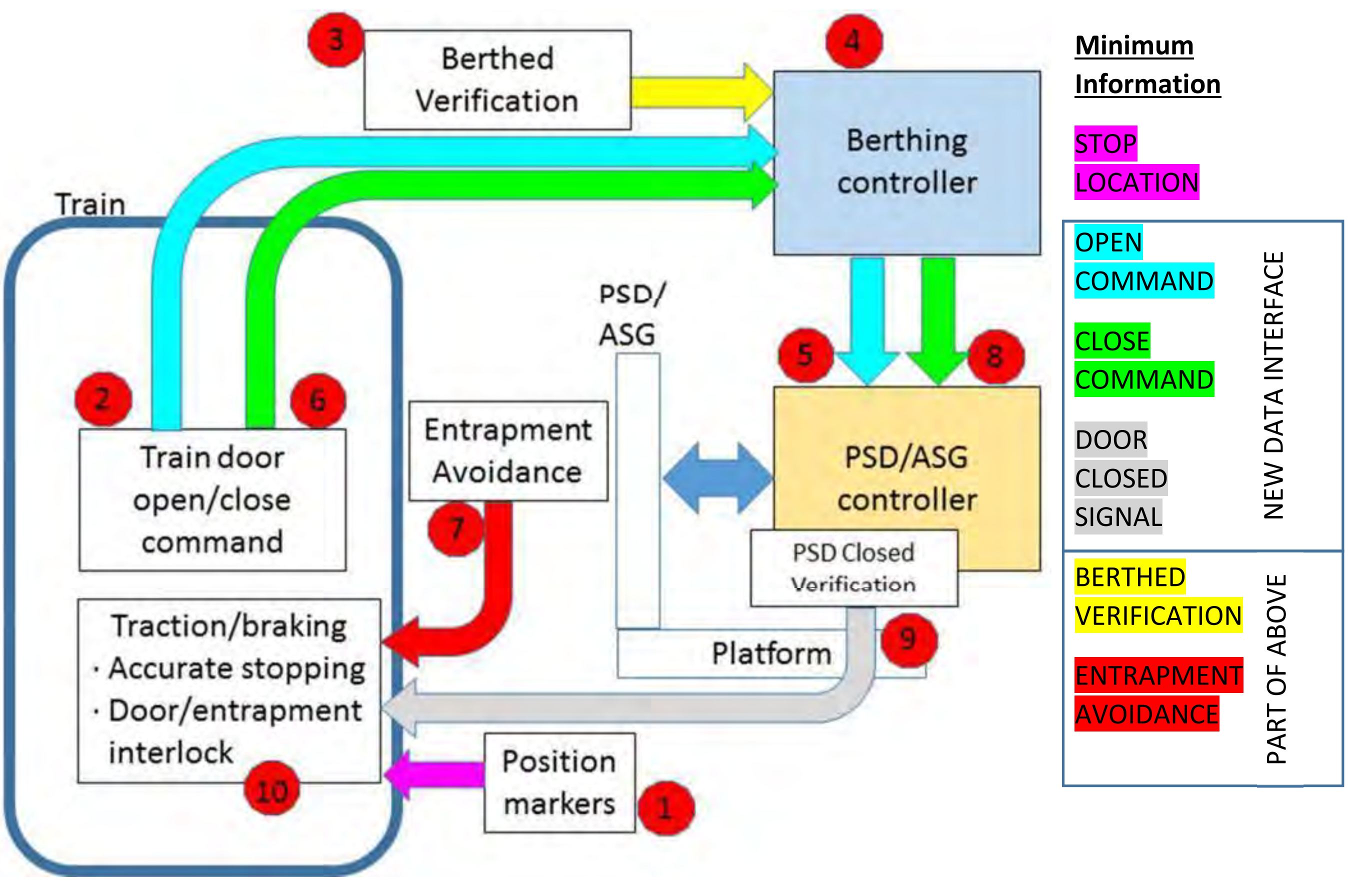
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

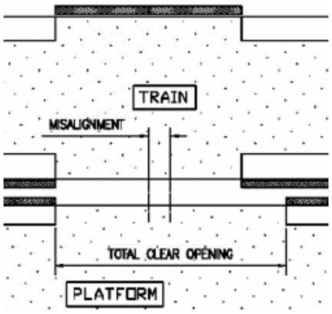
C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5” clear opening, a design for NY should meet the ADA Accessibility Guideline of 36”.

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a ‘distance totem’ which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy’s COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

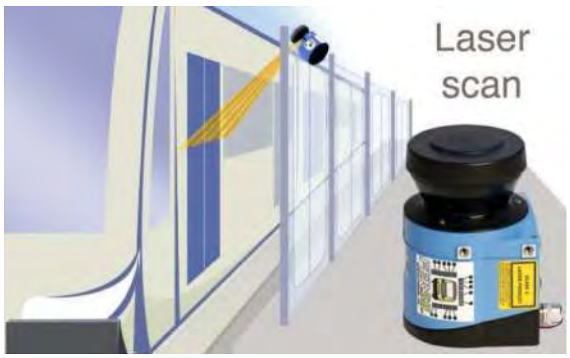
Dedicated Loop

The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically



If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.

For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4'-0"). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

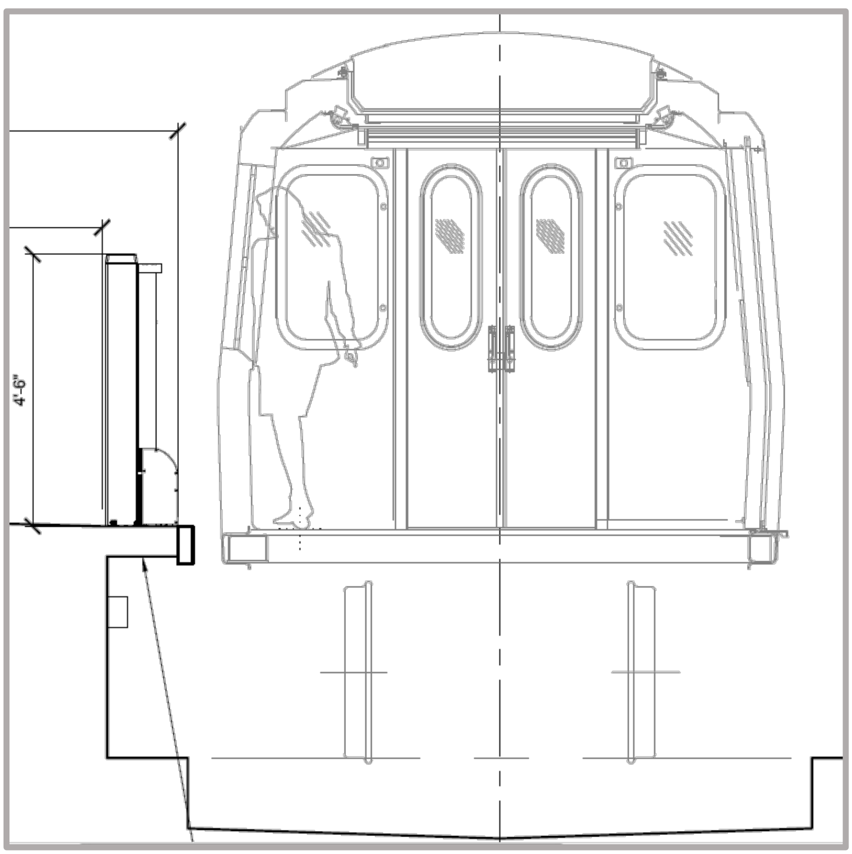


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

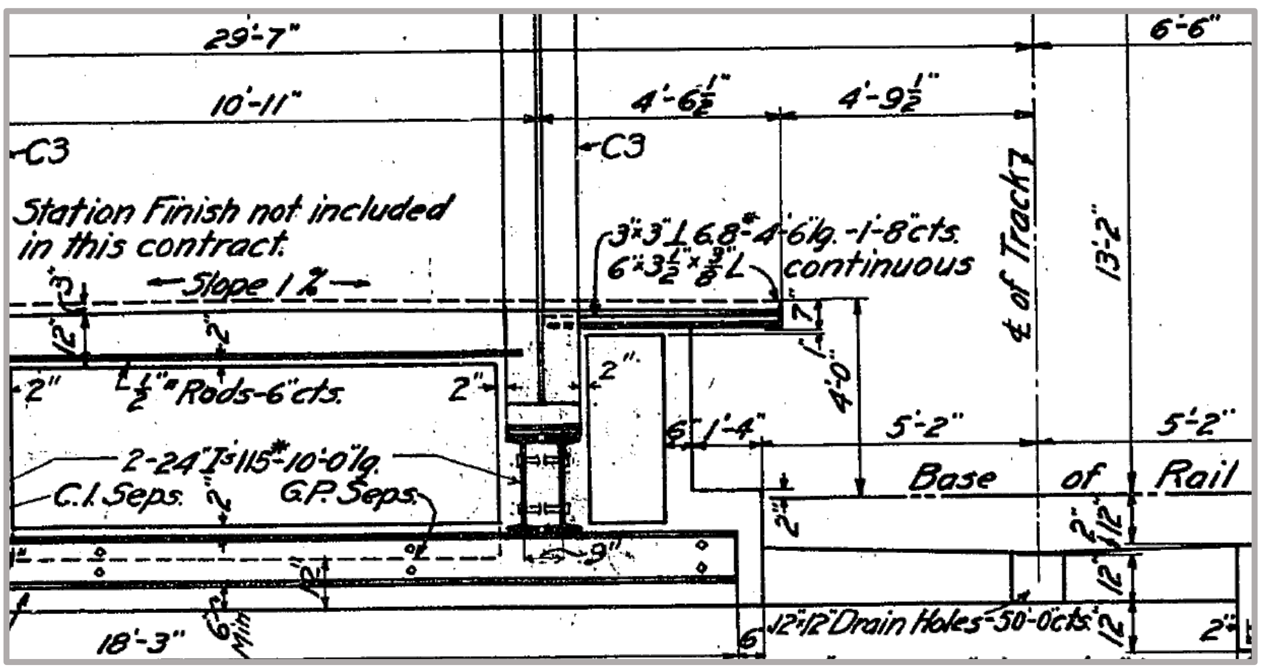


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

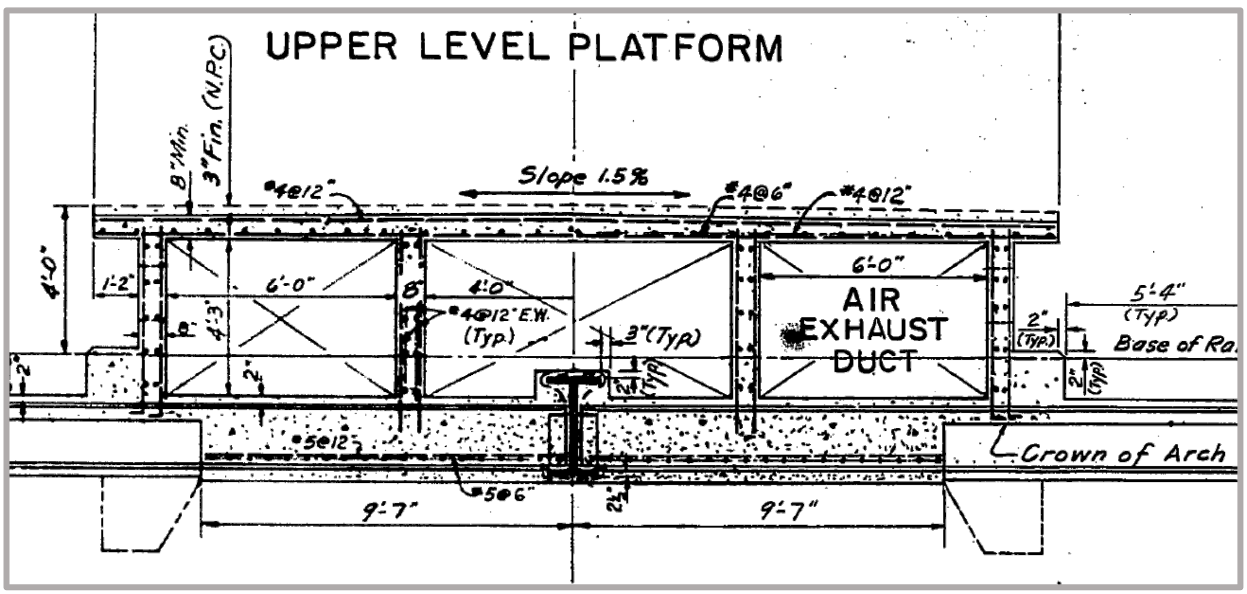


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

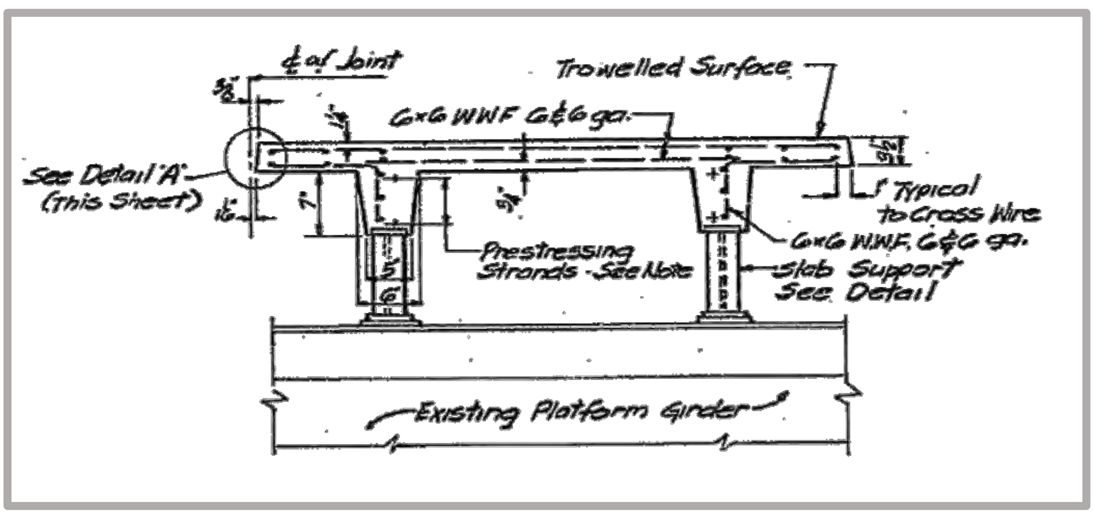


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

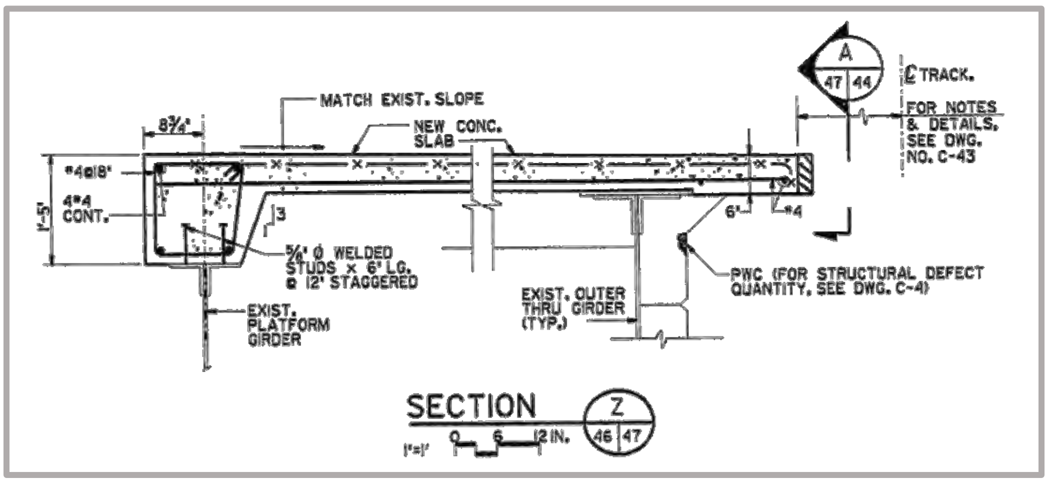


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2’-9”), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

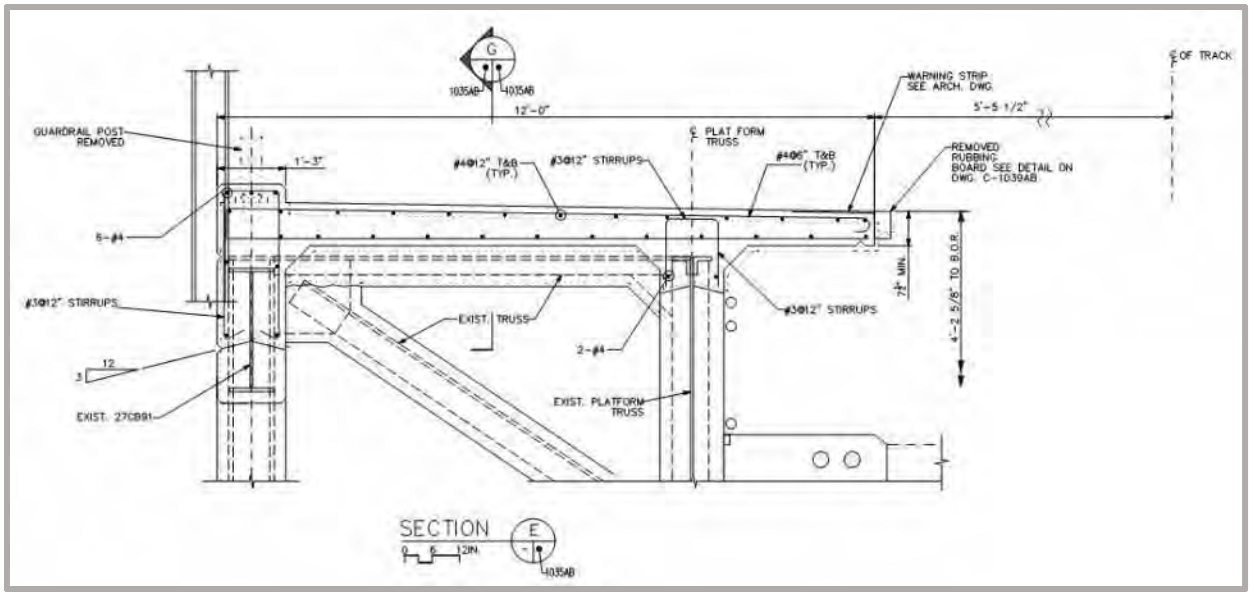


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3” thick structural slab with an approximately 3” thick topping slab. If the topping slab is fully removed, a 6” thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6” thick slab will be sufficient for a cantilever length of up to approximately 3’-0”, greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6” structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6” minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

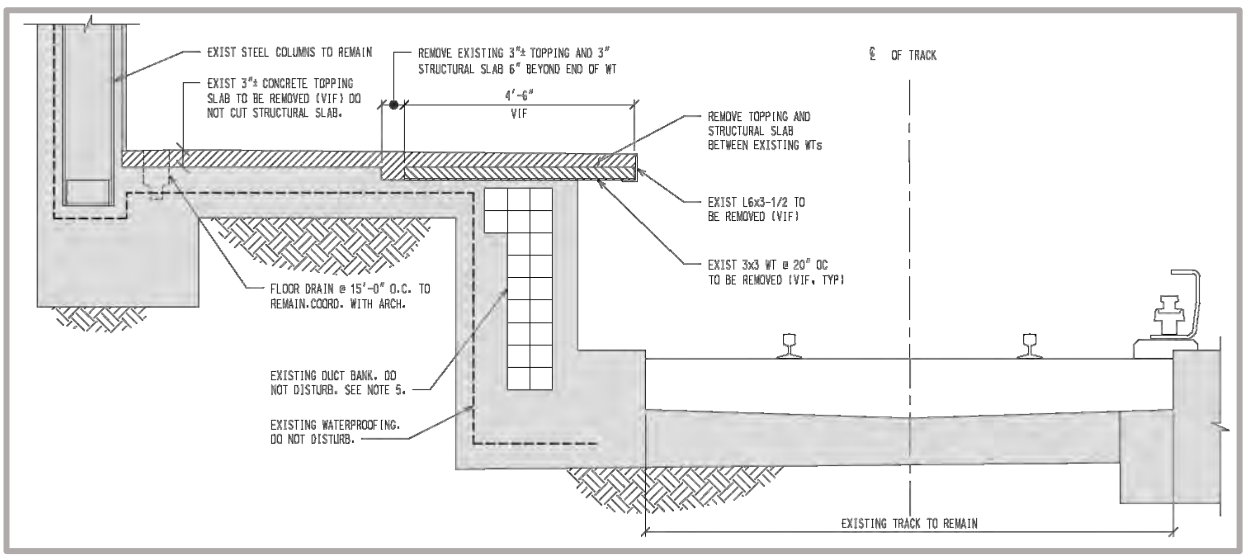


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

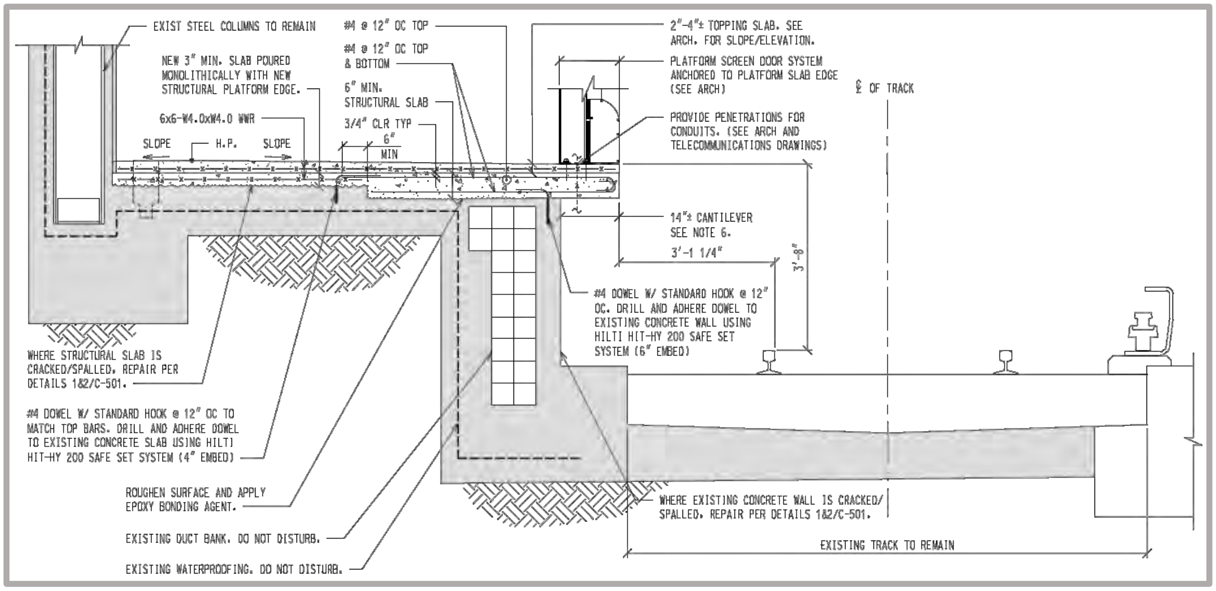


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

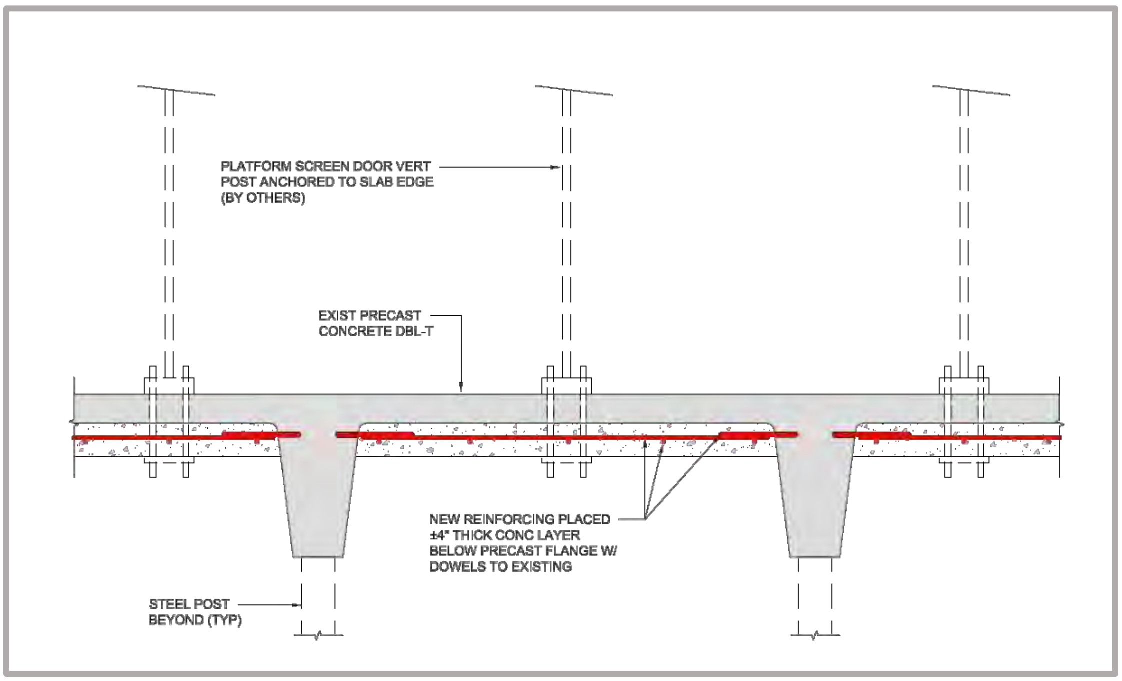


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5' – 11" of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis

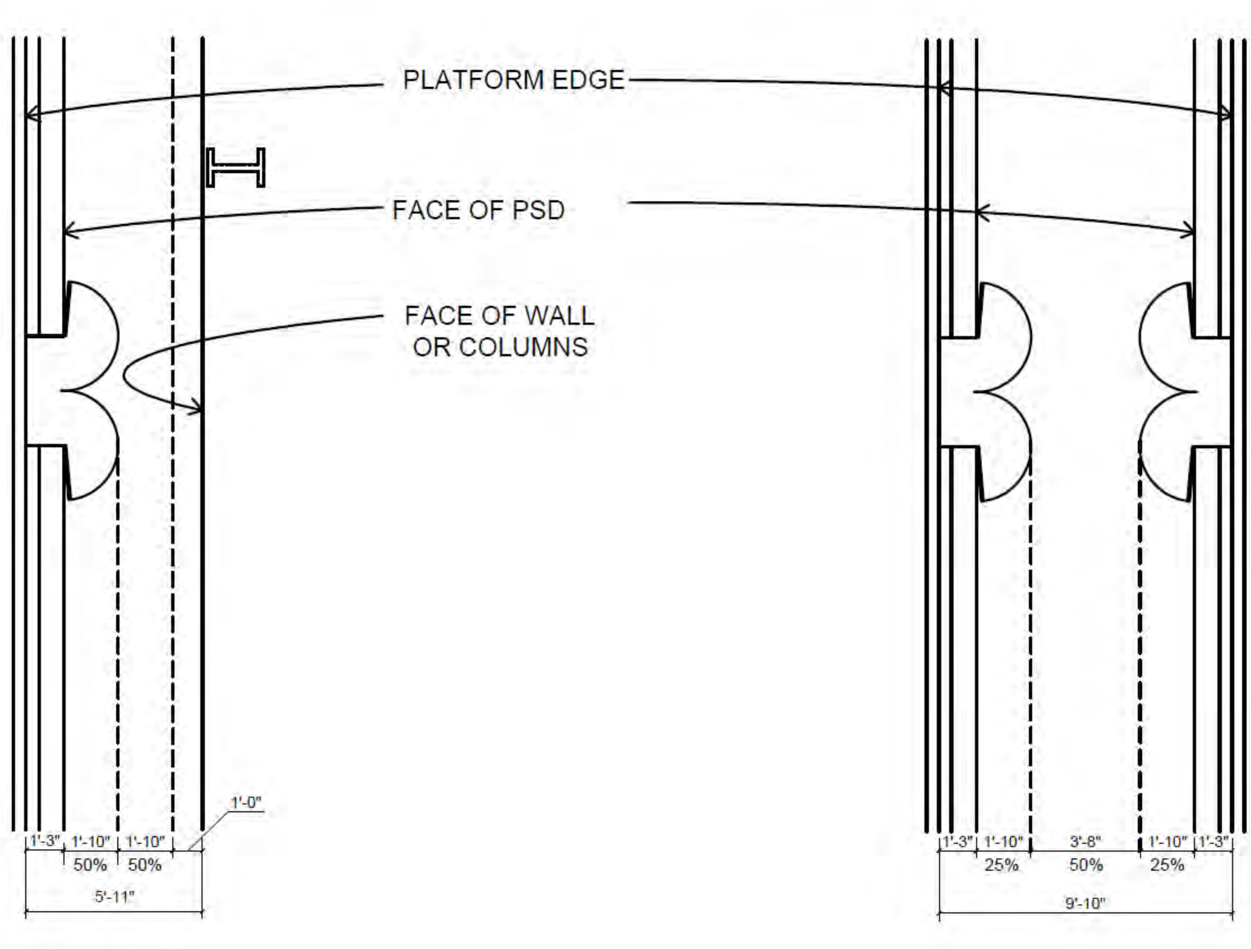


FIGURE 1: SIDE PLATFORM

FIGURE 2: CENTER PLATFORM

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the	9	$ 63,500 per month [Year 01]	$ 571,500		
	platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance	12	$ 83,590 per month [Year 02]	$ 1,003,080		
	since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
	remedial repair performed as needed, 24/7, for the	12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
	platform screen door system and ancillary equipment.					
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663		

7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *	
		Year 3	$ 257 per hour *	
	Optional :	Year 4	$ 268 per hour *	
	Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations
ESTIMATE DATE:	June 12, 2019

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

MTA/NYCT

June 12, 2019

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.2 *APGs / PSDs will provide 39 emergency egress doors with push bars per platform*
1.3 *Each platform edge will have 50 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 It is assumed that each train has 10 cars on this line
2.2 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.3 In respect of the PSD option, only platforms that have not been upgraded in the recent past will require platform edge replacement.
2.4 There are no special security requirements made necessary by installation of the APG system
2.5 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.6 This estimate does not provide for the replacement of Platform Edge Lighting
2.7 Premium cost for night time work is considered 50% of total labor cost

3.0 ***Exclusions - Costs not included in the estimate:***

VJ ASSOCIATES
ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

MTA/NYCT

June 12, 2019

BASIS OF ESTIMATE

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems
3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length
3.4 Costs associated with NYCT State Of Good Repair improvements to the station
3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.
3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs
3.7 Escalation Cost is not included; Anticipate at 5% per annum.
3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.
3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium
3.10 NYCT project cost is not included
3.11 GO and flagging cost is not included
3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or "soft" costs:***

4.1 Design and Construction Contingency
4.2 Contractor O & P
4.3 Insurance
4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 Given the limited time available, no drawings were developed to support this estimate.

MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

June 12, 2019

ORDER OF MAGNITUDE COSTS			MRN 010	MRN 049	MRN 053	MRN 058	MRN 223	MRN 475	MRN 476	MRN 477
	DESCRIPTION		49TH STREET	AVENUE J	NECK ROAD	CONEY ISLAND	LEXINGTON AVE - 63RD ST.	96TH STREET	86TH STREET	72ND STREET
1	AUTOMATIC PLATFORM GATES (APG'S)		$17,737,576	$16,757,561	$16,704,135	$16,451,775	$16,732,028	$16,524,755	$16,635,852	$16,659,613
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$17,737,576	$16,757,561	$16,704,135	$16,451,775	$16,732,028	$16,524,755	$16,635,852	$16,659,613
4	GENERAL REQUIREMENTS	15.00%	$2,660,636	$2,513,634	$2,505,620	$2,467,766	$2,509,804	$2,478,713	$2,495,378	$2,498,942
	SUB-TOTAL:		$20,398,212	$19,271,195	$19,209,755	$18,919,541	$19,241,832	$19,003,468	$19,131,229	$19,158,555
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$5,099,553	$4,817,799	$4,802,439	$4,729,885	$4,810,458	$4,750,867	$4,782,807	$4,789,639
	SUB-TOTAL:		$25,497,765	$24,088,994	$24,012,194	$23,649,426	$24,052,291	$23,754,335	$23,914,037	$23,948,194
6	OVERHEAD & PROFIT	15.00%	$3,824,665	$3,613,349	$3,601,829	$3,547,414	$3,607,844	$3,563,150	$3,587,106	$3,592,229
	SUB-TOTAL:		$29,322,430	$27,702,343	$27,614,023	$27,196,840	$27,660,134	$27,317,486	$27,501,142	$27,540,423
7	BONDS & INSURANCE	3.75%	$1,099,591	$1,038,838	$1,035,526	$1,019,882	$1,037,255	$1,024,406	$1,031,293	$1,032,766
	SUB-TOTAL:		$30,422,021	$28,741,181	$28,649,549	$28,216,722	$28,697,389	$28,341,891	$28,532,435	$28,573,189
	SUBTOTAL CONSTRUCTION COST W/O ACM		$30,422,021	$28,741,181	$28,649,549	$28,216,722	$28,697,389	$28,341,891	$28,532,435	$28,573,189
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		$30,422,021	$28,741,181	$28,649,549	$28,216,722	$28,697,389	$28,341,891	$28,532,435	$28,573,189
10	DESIGN CONSULTANT FEES	10.00%	$3,042,202	$2,874,118	$2,864,955	$2,821,672	$2,869,739	$2,834,189	$2,853,244	$2,857,319
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		$33,464,223	$31,615,299	$31,514,503	$31,038,394	$31,567,128	$31,176,080	$31,385,679	$31,430,508
	ADD ALTERNATIVES									
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		5,331,194	Not Applicable	Not Applicable	4,724,706	4,059,284	4,242,450	$4,115,036	$4,152,370
	Add for Markups (as above)	88.66%	4,726,791	Not Applicable	Not Applicable	4,189,061	3,599,078	3,761,478	3,648,510	3,681,611
	SUB-TOTAL PSD ALTERNATIVE		$10,057,985	$0	$0	$8,913,766	$7,658,362	$8,003,928	$7,763,545	$7,833,981
	TOTAL PROJECT COST (PSD OPTION)		$43,522,208	$0	$0	$39,952,160	$39,225,491	$39,180,008	$39,149,224	$39,264,488

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	703	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	703	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,406**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,406	LF	7	9,842
14	Remove 5' wide section of 3" deep structural slab to platform edge	7,030	SF	12	84,360
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	142	CY	2,500	355,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,408	EA	25	35,200
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,408	EA	25	35,200
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,406	LF	95	133,570
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,406	LF	15	21,090
26	Remove existing platform tiles	1,406	LF	12	16,872
27	Sawcut existing topping concrete at perimeter of removal area	1,406	LF	5	7,030
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,436	SF	8	67,488
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10' wide strip	320	SF	8	2,560
30	New Work				
31	New concrete topping to match existing	1,406	SF	15	21,090

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	320	SF	15	4,800
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room#1 [7'-6" x 17'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	32	LF	90	2,880
39	CMU Wall for equipment room	320	SF	45	14,400
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	128	SF	30	3,825
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	320	SF	40	12,800
45	Mosaic Band to match existing - Assuming 8" high	32	LF	120	3,840
46	Concrete cove to match existing	32	LF	20	640
47	Interior Wall Finish - Paint	320	SF	5	1,600
48	Allow for Misc. floor & ceiling finishes	128	SF	15	1,913
49	Allow for 4" thick concrete pads for equipment	32	SF	20	638
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Equipment Room#2 [7'-6" x 17'-0"]**				
56	Build off existing platform slab		Note		
57	Form 8" wide concrete curb including dowelling to platform slab	32	LF	90	2,880
58	CMU Wall for equipment room	320	SF	45	14,400
59	Vertical connections with existing structure	20	LF	25	500
60	Roof for equipment room	128	SF	30	3,825
61	Fire rated door including frame & hardware	1	EA	2,500	2,500
62	Exterior wall finish				
63	Ceramic Tiling to match existing	320	SF	40	12,800
64	Mosaic Band to match existing - Assuming 8" high	32	LF	120	3,840
65	Concrete cove to match existing	32	LF	20	640
66	Interior Wall Finish - Paint	320	SF	5	1,600
67	Allow for Misc. floor & ceiling finishes	128	SF	15	1,913
68	Allow for 4" thick concrete pads for equipment	32	SF	20	638
69	Allowance for Mechanical Scope	1	LS	40,000	40,000
70	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
71	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
72	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
73					
74	**Automatic Platform Gates [APGs] - 4'-6" High**				
75	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
76	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
77	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
78	Platform End Gates (PEGs)	4	EA	13,000	52,000
79	Fixed Panels including framing and support; 4'-6" High	3,042	SF	750	2,281,500
80	Spare Parts - Approx. 10% of Material Cost	1	LS	263,550	263,550
81	Testing and commissioning	800	HRS	160	127,944
82	Product Warranty	1	LS	1,000,000	1,000,000
83	Allowance for Braille Signage	80	EA	2,500	200,000
84					
85	**Electrical**				
86	Electrical Upgrades				
87	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
88	Power and Lighting				
89	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
90	Allow for conduit / cable runs for power and communications under platform edge	1,406	LF	60	84,360
91	PSD Connections	1	LS	75,000	75,000
92	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
93	Power to PSD Rooms from EDR [Conduit & Cable]	350	LF	60	21,000
94	Reserve power to PSD Room from EDR [Conduit & Cable]	400	LF	60	24,000
95	No allowance for new lighting as if APG's are used		Note		EXCL.
96	Grounding				
97	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
98	MISC				
99	Testing and commissioning	1	EA	30,000	30,000
100	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
101					
102	**Communications**				
103	FA System				
104	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
105	CCTV coverage				
106	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
107	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
108	Berthing Technology Sensors				

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
109	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
110	Train Door Detection System				
111	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
112	Entrapment concerns				
113	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
114	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
115	Engineering and Testing	1,000	Hrs	160	159,930
116	Centralized monitoring/control				
117	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
118	MISC				
119	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
120	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
121	Site Survey and Inspections	1	LS	100,000	100,000
122	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
123	Furnish Test Equipment allowance	1	LS	500,000	500,000
124	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
125					
126	Training				
127	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
128					
129	Out of hours Work				
130	Allow loss of production to work at night say 50%	1	LS	4,093,287	4,093,287
131					
132	TOTAL PSD WORK:				$ 17,737,576

134					
135	ADD ALTERNATIVE				
136					
137	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
138					
139	ADD				
140	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
141	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
142	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
143	Platform End Gates (PEGs)	4	EA	18,000	72,000
144	Fixed Panels including framing and support; Assuming 8'-0" high	6,382	SF	750	4,786,365
145	Spare Parts - Approx. 10% of Material Cost	1	LS	485,302	485,302
146	Structual framing / bracing				
147	HSS4x4x1/2 hanger	5	TONS	17,500	93,155
148	L6x6x1/2 continuous angle	10	TONS	17,500	181,093
149	Drilling and bolting - 4 bolts at each connection	562	EA	216	121,478
150	Platform Edge Repair				
151	Remove concrete platform edge				Previously done
152	Platform edge repair				Previously done
153	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
154	Signal Work [Each 300' length is associated with one signal light]				
155	Disconnects	120	HRS	162	19,440
156	Remove signal cables	900	LF	40	36,000
157	Remove conduit; Assuming 1"	900	LF	55	49,500
158	Install conduit in new position	900	LF	110	99,000
159	Install replacement cable; assumed single cable #12	900	LF	125	112,500
160	Re-commission / testing as required	3	EA	12,500	37,500
161	Engineering / Shop Drawings / Etc.	3	EA	7,500	22,500
162	Premium Time	2,353	HRS	49	114,356
163					
164	OMIT				
165	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
166	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
167	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
168	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
169	Fixed Panels including framing and support; 4'-6" High	(3,042)	SF	750	(2,281,500)
170	Spare Parts - Approx. 10% of Material Cost	(1)	LS	263,550	(263,550)
171	Platform Edge Reconstruction work	(1)	LS	624,960	(624,960)
172	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
173	Conduit running under Platform Edge	(1,406)	LF	30	(42,180)
175	Allow loss of production to work at night say 50%	1	LS	1,230,276	1,230,276
176					
177					
178	PREMIUM ASSOCIATED WITH PSD's				$ 5,331,194

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : AVENUE J

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	624	LF		
5	LENGTH OF THE PLATFORM EDGE =	611	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,234**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,234	LF	7	8,640
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,171	SF	12	74,055
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,236	EA	25	30,906
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,236	EA	25	30,906
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,234	LF	95	117,254
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,234	LF	15	18,514
26	Remove existing platform tiles	1,234	LF	12	14,811
27	Sawcut existing topping concrete at perimeter of removal area	1,234	LF	5	6,171
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,406	SF	8	59,244
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Platform width i.e. 8'-0" wide	160	SF	8	1,280
30	New Work				
31	New concrete topping to match existing	1,234	SF	15	18,514

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : AVENUE J

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	160	SF	15	2,400
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-6" x 27'-6"]**				
37	Build off new slab on grade beyond the existing platform		Note		
38	Structural fill for embankment beyond the platform upto platform level [Assumed 4' deep in the absence of detail]	35	CY	40	1,385
39	Mud slab (+/- 6" thick) under slab on grade	305	SF	12	3,660
40	Cast in place concrete slab on grade - 12" thick [Assumed 4' deep in the absence of detail]	7	CY	2,250	16,042
41	Piling				
42	Mobilization	1	LS	30,000	30,000
43	Mini Piles; #4 No. - Circa 40'-0" deep in Rock	160	LF	450	72,000
44	Pile Cap; 7'-0" x 4'-0" x 3'-0"; (2 No.)	6	CY	2,750	17,111
45	Grade Beam connecting pile caps; 19'-6" x 1'-6" x 2'-0"; (2 No.)	4	CY	2,250	9,750
46	Form 8" wide concrete curb including dowelling to platform slab	70	LF	90	6,300
47	CMU Wall for equipment room	700	SF	45	31,500
48	Vertical connections with existing structure	20	LF	25	500
49	Roof for equipment room	206	SF	30	6,188
50	Fire rated door including frame & hardware	1	EA	2,500	2,500
51	Exterior wall finish				
52	Ceramic Tiling to match existing	700	SF	40	28,000
53	Mosaic Band to match existing - Assuming 8" high	70	LF	120	8,400
54	Concrete cove to match existing	70	LF	20	1,400
55	Interior Wall Finish - Paint	700	SF	5	3,500
56	Allow for Misc. floor & ceiling finishes	206	SF	15	3,094
57	Allow for 4" thick concrete pads for equipment	52	SF	20	1,031
58	Allowance for Mechanical Scope	1	LS	40,000	40,000
59	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
60	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
61	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
62					
63	**Automatic Platform Gates [APGs] - 4'-6" High**				
64	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
65	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
66	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
67	Platform End Gates (PEGs)	4	EA	13,000	52,000
68	Fixed Panels including framing and support; 4'-6" High	2,269	SF	750	1,701,844
69	Spare Parts - Approx. 10% of Material Cost	1	LS	228,771	228,771
70	Testing and commissioning	800	HRS	160	127,944

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : AVENUE J

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Product Warranty	1	LS	1,000,000	1,000,000
72	Allowance for Braille Signage	80	EA	2,500	200,000
73					
74	**Electrical**				
75	Electrical Upgrades				
76	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
77	Power and Lighting				
78	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
79	Allow for conduit / cable runs for power and communications under platform edge	1,234	LF	60	74,055
80	PSD Connections	1	LS	75,000	75,000
81	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
82	Power to PSD Room from EDR [Conduit & Cable]	650	LF	60	39,000
83	Reserve power to PSD Room from EDR [Conduit & Cable]	700	LF	60	42,000
84	No allowance for new lighting as if APG's are used		Note		EXCL.
85	Grounding				
86	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
87	MISC				
88	Testing and commissioning	1	EA	30,000	30,000
89	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
90					
91	**Communications**				
92	FA System				
93	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
94	CCTV coverage				
95	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
96	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
97	Berthing Technology Sensors				
98	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
99	Train Door Detection System				
100	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
101	Entrapment concerns				
102	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
103	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
104	Engineering and Testing	1,000	Hrs	160	159,930
105	Centralized monitoring/control				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : AVENUE J

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
106	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
107	MISC				
108	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
109	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
110	Site Survey and Inspections	1	LS	100,000	100,000
111	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
112	Furnish Test Equipment allowance	1	LS	500,000	500,000
113	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
114					
115	Training				
116	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
117					
118	Out of hours Work				
119	Allow loss of production to work at night say 50%	1	LS	3,867,129	3,867,129
120					
121	TOTAL PSD WORK:				$ 16,757,561
123					
124	ADD ALTERNATIVE				
125					
126	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
127					
128	ADD				
129	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)				Not Applicable
130	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
131	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
132	Platform End Gates (PEGs)				Not Applicable
133	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
134	Spare Parts - Approx. 10% of Material Cost				Not Applicable
135	Structual framing / bracing				
136	HSS4x4x1/2 hanger				Not Applicable
137	L6x6x1/2 continuous angle				Not Applicable
138	Drilling and bolting - 4 bolts at each connection				Not Applicable
139	Platform Edge Repair				
140	Remove concrete platform edge				Previously done
141	Platform edge repair				Previously done
142	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : AVENUE J

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
143	Signal Work [Each 300' length is associated with one signal light]				
144	Disconnects				Not Applicable
145	Remove signal cables				Not Applicable
146	Remove conduit; Assuming 1"				Not Applicable
147	Install conduit in new position				Not Applicable
148	Install replacement cable; assumed single cable #12				Not Applicable
149	Re-commission / testing as required				Not Applicable
150	Engineering / Shop Drawings / Etc.				Not Applicable
151	Premium Time				Not Applicable
152					
153	OMIT				
154	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
155	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
156	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
157	Platform End Gates (PEGs)				Not Applicable
158	Fixed Panels including framing and support; 4'-6" High				Not Applicable
159	Spare Parts - Approx. 10% of Material Cost				Not Applicable
160	Platform Edge Reconstruction work				Not Applicable
161	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
162	Conduit running under Platform Edge				Not Applicable
163					
164	Allow loss of production to work at night say 50%				Not Applicable
165					
166	PREMIUM ASSOCIATED WITH PSD's				$ -

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : NECK ROAD

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	618	LF		
5	LENGTH OF THE PLATFORM EDGE =	618	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,236**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,236	LF	7	8,652
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,180	SF	12	74,160
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,238	EA	25	30,950
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,238	EA	25	30,950
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,236	LF	95	117,420
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,236	LF	15	18,540
26	Remove existing platform tiles	1,236	LF	12	14,832
27	Sawcut existing topping concrete at perimeter of removal area	1,236	LF	5	6,180
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,416	SF	8	59,328
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Platform width i.e. 8'-0" wide	160	SF	8	1,280
30	New Work				
31	New concrete topping to match existing	1,236	SF	15	18,540

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : NECK ROAD

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	160	SF	15	2,400
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36					
37	**Equipment Room [7'-6" x 27'-6"]**				
38	Build off new slab on grade beyond the existing platform		Note		
39	Structural fill for embankment beyond the platform upto platform level [Assumed 4' deep in the absence of detail]	35	CY	40	1,385
40	Mud slab (+/- 6" thick) under slab on grade	305	SF	12	3,660
41	Cast in place concrete slab on grade - 12" thick [Assumed 4' deep in the absence of detail]	7	CY	2,250	16,042
42	Piling				
43	Mobilization	1	LS	30,000	30,000
44	Mini Piles; #4 No. - Circa 40'-0" deep in Rock	160	LF	450	72,000
45	Pile Cap; 7'-0" x 4'-0" x 3'-0"; (2 No.)	6	CY	2,750	17,111
46	Grade Beam connecting pile caps; 19'-6" x 1'-6" x 2'-0"; (2 No.)	4	CY	2,250	9,750
47	Form 8" wide concrete curb including dowelling to platform slab	70	LF	90	6,300
48	CMU Wall for equipment room	700	SF	45	31,500
49	Vertical connections with existing structure	20	LF	25	500
50	Roof for equipment room	206	SF	30	6,188
51	Fire rated door including frame & hardware	1	EA	2,500	2,500
52	Exterior wall finish				
53	Ceramic Tiling to match existing	700	SF	40	28,000
54	Mosaic Band to match existing - Assuming 8" high	70	LF	120	8,400
55	Concrete cove to match existing	70	LF	20	1,400
56	Interior Wall Finish - Paint	700	SF	5	3,500
57	Allow for Misc. floor & ceiling finishes	206	SF	15	3,094
58	Allow for 4" thick concrete pads for equipment	52	SF	20	1,031
59	Allowance for Mechanical Scope	1	LS	40,000	40,000
60	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
61	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
62	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
63					
64	**Automatic Platform Gates [APGs] - 4'-6" High**				
65	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
66	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
67	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
68	Platform End Gates (PEGs)	4	EA	13,000	52,000
69	Fixed Panels including framing and support; 4'-6" High	2,277	SF	750	1,707,750
70	Spare Parts - Approx. 10% of Material Cost	1	LS	229,125	229,125

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : NECK ROAD

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Testing and commissioning	800	HRS	160	127,944
72	Product Warranty	1	LS	1,000,000	1,000,000
73	Allowance for Braille Signage	80	EA	2,500	200,000
74					
75	**Electrical**				
76	Electrical Upgrades				
77	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
78	Power and Lighting				
79	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
80	Allow for conduit / cable runs for power and communications under platform edge	1,236	LF	60	74,160
81	PSD Connections	1	LS	75,000	75,000
82	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
83	Power to PSD Room from EDR [Conduit & Cable]	250	LF	60	15,000
84	Reserve power to PSD Room from EDR [Conduit & Cable]	300	LF	60	18,000
85	No allowance for new lighting as if APG's are used		Note		EXCL.
86	Grounding				
87	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
88	MISC				
89	Testing and commissioning	1	EA	30,000	30,000
90	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
91					
92	**Communications**				
93	FA System				
94	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
95	CCTV coverage				
96	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
97	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
98	Berthing Technology Sensors				
99	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
100	Train Door Detection System				
101	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
102	Entrapment concerns				
103	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
104	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
105	Engineering and Testing	1,000	Hrs	160	159,930
106	Centralized monitoring/control				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : NECK ROAD

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
107	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
108	MISC				
109	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
110	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
111	Site Survey and Inspections	1	LS	100,000	100,000
112	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
113	Furnish Test Equipment allowance	1	LS	500,000	500,000
114	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
115					
116	Training				
117	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
118					
119	Out of hours Work				
120	Allow loss of production to work at night say 50%	1	LS	3,854,800	3,854,800
121					
122	TOTAL PSD WORK:				$ 16,704,135
124					
125	ADD ALTERNATIVE				
126					
127	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
128					
129	ADD				
130	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)				Not Applicable
131	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
132	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
133	Platform End Gates (PEGs)				Not Applicable
134	Fixed Panels including framing and support; Assuming 8'-0" high				Not Applicable
135	Spare Parts - Approx. 10% of Material Cost				Not Applicable
136	Structual framing / bracing				
137	HSS4x4x1/2 hanger				Not Applicable
138	L6x6x1/2 continuous angle				Not Applicable
139	Drilling and bolting - 4 bolts at each connection				Not Applicable
140	Platform Edge Repair				
141	Remove concrete platform edge				Previously done
142	Platform edge repair				Previously done
143	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : NECK ROAD

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144	Signal Work [Each 300' length is associated with one signal light]				
145	Disconnects				Not Applicable
146	Remove signal cables				Not Applicable
147	Remove conduit; Assuming 1"				Not Applicable
148	Install conduit in new position				Not Applicable
149	Install replacement cable; assumed single cable #12				Not Applicable
150	Re-commission / testing as required				Not Applicable
151	Engineering / Shop Drawings / Etc.				Not Applicable
152	Premium Time				Not Applicable
153					
154	OMIT				
155	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)				Not Applicable
156	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform				Not Applicable
157	Double egress/service gate in the center of the platform; #1 per Platform				Not Applicable
158	Platform End Gates (PEGs)				Not Applicable
159	Fixed Panels including framing and support; 4'-6" High				Not Applicable
160	Spare Parts - Approx. 10% of Material Cost				Not Applicable
161	Platform Edge Reconstruction work				Not Applicable
162	Remove allowance for cast in sleeves for LV & HV power				Not Applicable
163	Conduit running under Platform Edge				Not Applicable
164					
165	Allow loss of production to work at night say 50%				Not Applicable
166					
167	PREMIUM ASSOCIATED WITH PSD's				$ -

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : CONEY ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	615	LF		
5	LENGTH OF THE PLATFORM EDGE =	616	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,231**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,231	LF	7	8,617
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,155	SF	12	73,860
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,233	EA	25	30,825
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,233	EA	25	30,825
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,231	LF	95	116,945
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,231	LF	15	18,465
26	Remove existing platform tiles	1,231	LF	12	14,772
27	Sawcut existing topping concrete at perimeter of removal area	1,231	LF	5	6,155
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,386	SF	8	59,088
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Platform width i.e. 27'-6" wide strip	620	SF	8	4,960
30	New Work				
31	New concrete topping to match existing	1,231	SF	15	18,465

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : CONEY ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	620	SF	15	9,300
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [12'-0" x 16'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	56	LF	90	5,040
39	CMU Wall for equipment room	560	SF	45	25,200
40	Vertical connections with existing structure	-	LF	25	-
41	Roof for equipment room	192	SF	30	5,760
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	560	SF	40	22,400
45	Mosaic Band to match existing - Assuming 8" high	56	LF	120	6,720
46	Concrete cove to match existing	56	LF	20	1,120
47	Interior Wall Finish - Paint	560	SF	5	2,800
48	Allow for Misc. floor & ceiling finishes	192	SF	15	2,880
49	Allow for 4" thick concrete pads for equipment	48	SF	20	960
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,255	SF	750	1,690,875
61	Spare Parts - Approx. 10% of Material Cost	1	LS	228,113	228,113
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : CONEY ISLAND

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,231	LF	60	73,860
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : CONEY ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,796,563	3,796,563
112					
113	**TOTAL PSD WORK:**				**$ 16,451,775**
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,982	SF	750	3,736,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	422,302	422,302
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,723
129	L6x6x1/2 continuous angle	9	TONS	17,500	158,553
130	Drilling and bolting - 4 bolts at each connection	492	EA	216	106,358
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	120	HRS	162	19,440
137	Remove signal cables	900	LF	40	36,000
138	Remove conduit; Assuming 1"	900	LF	55	49,500
139	Install conduit in new position	900	LF	110	99,000
140	Install replacement cable; assumed single cable #12	900	LF	125	112,500
141	Re-commission / testing as required	3	EA	12,500	37,500
142	Engineering / Shop Drawings / Etc.	3	EA	7,500	22,500
143	Premium Time	2,353	HRS	49	114,356

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : CONEY ISLAND

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,255)	SF	750	(1,690,875)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	228,113	(228,113)
152	Platform Edge Reconstruction work	(1)	LS	560,710	(560,710)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,231)	LF	30	(36,930)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,090,317	1,090,317
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,724,706

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : LEXINGTON AVE - 63RD ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	615	LF		
5	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	615	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,230**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,230	LF	7	8,610
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,150	SF	12	73,800
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,232	EA	25	30,800
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,232	EA	25	30,800
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,230	LF	95	116,850
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,230	LF	15	18,450
26	Remove existing platform tiles	1,230	LF	12	14,760
27	Sawcut existing topping concrete at perimeter of removal area	1,230	LF	5	6,150
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,380	SF	8	59,040
29	Remove existing 3" concrete topping at 44' long ADA boarding area; Platform width i.e. 21'-6" wide strip at ADA boarding area	418	SF	8	3,344
30	New Work				
31	New concrete topping to match existing	1,230	SF	15	18,450
32	New concrete topping at ADA boarding area to match existing	418	SF	15	6,270

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : LEXINGTON AVE - 63RD ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [12'-0" x 16'-0"]**				
37	Build off existing Mezzanine Slab; 3 Walls only		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	56	LF	90	5,040
39	CMU Wall for equipment room	560	SF	45	25,200
40	Vertical connections with existing structure	-	LF	25	-
41	Fire rated door including frame & hardware	1	EA	2,500	2,500
42	Exterior wall finish				
43	Ceramic Tiling to match existing	560	SF	40	22,400
44	Mosaic Band to match existing - Assuming 8" high	56	LF	120	6,720
45	Concrete cove to match existing	56	LF	20	1,120
46	Interior Wall Finish - Paint	560	SF	5	2,800
47	Allow for Misc. floor & ceiling finishes	192	SF	15	2,880
48	Allow for 4" thick concrete pads for equipment	48	SF	20	960
49	Allowance for Mechanical Scope	1	LS	40,000	40,000
50	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
51	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
52	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54	**Automatic Platform Gates [APGs] - 4'-6" High**				
55	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
56	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
57	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
58	Platform End Gates (PEGs)	4	EA	13,000	52,000
59	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
60	Spare Parts - Approx. 10% of Material Cost	1	LS	227,910	227,910
61	Testing and commissioning	800	HRS	160	127,944
62	Product Warranty	1	LS	1,000,000	1,000,000
63	Allowance for Braille Signage	80	EA	2,500	200,000
64					
65	**Electrical**				
66	Electrical Upgrades				
67	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
68	Power and Lighting				
69	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
70	Allow for conduit / cable runs for power and communications under platform edge	1,230	LF	60	73,800
	PSD Connections	1	LS	75,000	75,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : LEXINGTON AVE - 63RD ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
72	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	200,000	200,000
73	Power to PSD Room from EDR including track crossing if needed	750	LF	60	45,000
74	Reserve power to PSD Room from EDR including track crossing if needed	750	LF	60	45,000
75	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
76	Grounding				
77	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	30,000	30,000
78	MISC				
79	Testing and commissioning	1	LS	30,000	30,000
80	As Built, Shop Drwgs, Permits and approvals	1	LS	20,000	20,000
81					
82	**Communications**				
83	FA System				
84	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
85	CCTV coverage				
86	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
87	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
88	Berthing Technology Sensors				
89	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
90	Train Door Detection System				
91	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
92	Entrapment concerns				
93	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
94	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
95	Engineering and Testing	2,000	Hrs	160	319,860
96	Centralized monitoring/control				
97	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
98	MISC				
99	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
100	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
101	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : LEXINGTON AVE - 63RD ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
103	Furnish Test Equipment allowance	1	LS	500,000	500,000
104	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
105					
106	**Training**				
107	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
108					
109	**Out of hours Work**				
110	Allow loss of production to work at night say 50%	1	LS	3,861,237	3,861,237
112	TOTAL PSD WORK:				$ 16,732,028

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
114					
115	ADD ALTERNATIVE				
116					
117	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
118					
119	ADD				
120	Automatic bi-parting doors (10 Cars x 4 Doors = 40 No. per platform)	80	EA	25,000	2,000,000
121	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
122	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
123	Platform End Gates (PEGs)	4	EA	18,000	72,000
124	Fixed Panels including framing and support; Assuming 8'-0" high	4,974	SF	750	3,730,365
125	Spare Parts - Approx. 10% of Material Cost	1	LS	421,942	421,942
126	Structual framing / bracing				
127	HSS4x4x1/2 hanger	5	TONS	17,500	81,657
128	L6x6x1/2 continuous angle	9	TONS	17,500	158,424
129	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
130	Platform Edge Repair - **Not Required**				
131	Remove concrete platform edge	-	LF	27	-
132	Platform edge repair	-	LF	109	-
133	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate	-	EA	10	-
134					
135	OMIT				
136	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
137	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
138	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
139	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
140	Fixed Panels including framing and support; 4'-6" High	(2,250)	SF	750	(1,687,500)
141	Spare Parts - Approx. 10% of Material Cost	(1)	LS	227,910	(227,910)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : LEXINGTON AVE - 63RD ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
142	Platform Edge Reconstruction work	(1)	LS	560,600	(560,600)
143	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
144	Conduit running under Platform Edge	(1,230)	LF	30	(36,900)
145					
146	Allow loss of production to work at night say 50%	1	LS	936,758	936,758
147					
148	**PREMIUM ASSOCIATED WITH PSD's**				**4,059,284**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 96TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE UPPER PLATFORM EDGE=	627	LF		
5	LENGTH OF THE LOWER PLATFORM EDGE =	627	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,254**	**LF**		
7	NUMBER OF TRAIN CARS ON W TRAIN TRACK =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,254	LF	7	8,778
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,270	SF	12	75,240
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	126	CY	2,500	315,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,256	EA	25	31,400
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,256	EA	25	31,400
19	Cast in assemblies for PSD holding down bolts	320	EA	180	57,600
20	Polyethylene edge strip	1,254	LF	95	119,130
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,254	LF	15	18,810
26	Remove existing platform tiles	1,254	LF	12	15,048
27	Sawcut existing topping concrete at perimeter of removal area	1,254	LF	5	6,270
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,524	SF	8	60,192
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Platform width i.e. 30'-0" wide strip	720	SF	8	5,760
30	New Work				
31	New concrete topping to match existing	1,254	SF	15	18,810

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 96TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	720	SF	15	10,800
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	69	LF	90	6,210
39	CMU Wall for equipment room	690	SF	45	31,050
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	203	SF	30	6,075
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	690	SF	40	27,600
45	Mosaic Band to match existing - Assuming 8" high	69	LF	120	8,280
46	Concrete cove to match existing	69	LF	20	1,380
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	203	SF	15	3,038
49	Allow for 4" thick concrete pads for equipment	51	SF	20	1,013
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,358	SF	750	1,768,500
61	Spare Parts - Approx. 10% of Material Cost	1	LS	232,770	232,770
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 96TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,254	LF	60	75,240
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 96TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	Training				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	Out of hours Work				
111	Allow loss of production to work at night say 50%	1	LS	3,813,405	3,813,405
112					
113	TOTAL PSD WORK:				$ 16,524,755
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,166	SF	750	3,874,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	430,582	430,582
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	83,225
129	L6x6x1/2 continuous angle	9	TONS	17,500	161,515
130	Drilling and bolting - 4 bolts at each connection	502	EA	216	108,346
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 96TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,358)	SF	750	(1,768,500)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	232,770	(232,770)
152	Platform Edge Reconstruction work	(1)	LS	510,640	(510,640)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,254)	LF	30	(37,620)
155					
156	Allow loss of production to work at night say 50%	1	LS	979,027	979,027
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,242,450

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 86TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	623	LF		
5	LENGTH OF THE PLATFORM EDGE [ASTORIA BOUND] =	623	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,246**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,246	LF	7	8,722
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,230	SF	12	74,760
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	125	CY	2,500	312,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,248	EA	25	31,200
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,248	EA	25	31,200
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,246	LF	95	118,370
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,246	LF	15	18,690
26	Remove existing platform tiles	1,246	LF	12	14,952
27	Sawcut existing topping concrete at perimeter of removal area	1,246	LF	5	6,230
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,476	SF	8	59,808
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Platform width i.e. 28'-3" wide strip	650	SF	8	5,200
30	New Work				
31	New concrete topping to match existing	1,246	SF	15	18,690

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 86TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	650	SF	15	9,750
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room A [7'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	62	LF	90	5,535
39	CMU Wall for equipment room	615	SF	45	27,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	203	SF	30	6,075
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	615	SF	40	24,600
45	Mosaic Band to match existing - Assuming 8" high	62	LF	120	7,380
46	Concrete cove to match existing	62	LF	20	1,230
47	Interior Wall Finish - Paint	615	SF	5	3,075
48	Allow for Misc. floor & ceiling finishes	203	SF	15	3,038
49	Allow for 4" thick concrete pads for equipment	51	SF	20	1,013
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,322	SF	750	1,741,500
61	Spare Parts - Approx. 10% of Material Cost	1	LS	231,150	231,150
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 86TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,246	LF	60	74,760
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	700	LF	60	42,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	750	LF	60	45,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 86TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,839,043	3,839,043
112					
113	**TOTAL PSD WORK:**				**$ 16,635,852**
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,102	SF	750	3,826,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	427,702	427,702
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	82,702
129	L6x6x1/2 continuous angle	9	TONS	17,500	160,485
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 86TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,322)	SF	750	(1,741,500)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	231,150	(231,150)
152	Platform Edge Reconstruction work	(1)	LS	564,860	(564,860)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,246)	LF	30	(37,380)
155					
156	Allow loss of production to work at night say 50%	1	LS	949,624	949,624
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,115,036

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 72ND STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	625	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	625	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,250**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,250	LF	7	8,750
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,250	SF	12	75,000
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	126	CY	2,500	315,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,252	EA	25	31,300
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,252	EA	25	31,300
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,250	LF	95	118,750
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,250	LF	15	18,750
26	Remove existing platform tiles	1,250	LF	12	15,000
27	Sawcut existing topping concrete at perimeter of removal area	1,250	LF	5	6,250
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,500	SF	8	60,000
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Platform width i.e. 28'-3" wide strip	650	SF	8	5,200
30	New Work				
31	New concrete topping to match existing	1,250	SF	15	18,750

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 72ND STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	650	SF	15	9,750
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	62	LF	90	5,535
39	CMU Wall for equipment room	615	SF	45	27,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	203	SF	30	6,075
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	615	SF	40	24,600
45	Mosaic Band to match existing - Assuming 8" high	62	LF	120	7,380
46	Concrete cove to match existing	62	LF	20	1,230
47	Interior Wall Finish - Paint	615	SF	5	3,075
48	Allow for Misc. floor & ceiling finishes	203	SF	15	3,038
49	Allow for 4" thick concrete pads for equipment	51	SF	20	1,013
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,340	SF	750	1,755,000
61	Spare Parts - Approx. 10% of Material Cost	1	LS	231,960	231,960
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 72ND STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,250	LF	60	75,000
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Rooms from EDR [Conduit & Cable]	700	LF	60	42,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	750	LF	60	45,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
102	Site Survey and Inspections	1	LS	100,000	100,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 72ND STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,844,526	3,844,526
112					
113	**TOTAL PSD WORK:**				**$ 16,659,613**
115					
116	**ADD ALTERNATIVE**				
117					
118	**OPTION FOR PLATFORM SCREEN DOORS [PSDS]**				
119					
120	**ADD**				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	5,134	SF	750	3,850,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	429,142	429,142
127	Structural framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	82,964
129	L6x6x1/2 continuous angle	9	TONS	17,500	161,000
130	Drilling and bolting - 4 bolts at each connection	500	EA	216	108,000
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable
144					

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Q - Line Stations

12-Jun-19

STATION : 72ND STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,340)	SF	750	(1,755,000)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	231,960	(231,960)
152	Platform Edge Reconstruction work	(1)	LS	567,800	(567,800)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,250)	LF	30	(37,500)
156	Allow loss of production to work at night say 50%	1	LS	958,239	958,239
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,152,370

New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR 'R' LINE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017216

SUBMITTAL DATE: June 24, 2019

STV 100 Years

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Appendices

Appendix A: Tier 2-3 Technology assessment

Appendix B: Structural Feasibility Report

Appendix C: Emergency Egress Width Analysis

Appendix D: maintenance Cost Estimate

Appendix E: Rough Order of Magnitude Costs

Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 45 newly evaluated stations, 42 have been found to be not suitable for the installation of PSDs.

[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to low-height barriers]

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues; the platform edge barriers are 15" wide. Where an existing object (wall, stair, and railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Where these PSDs hamper the ability of a wheelchair to turn (a 5'-0" circle) and/or limit path of travel to less than 32" pinch width, it is declared infeasible. This requirement dictates that if a column or any obstruction measuring less than or equal to 24" in the direction of circulation is present, it may not constrain the circulation path to less than 32".
- Insufficient space for the PSD equipment room; the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow; due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements in regard to the placement of these new barriers in an existing station environment.
- Structural considerations; existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.

- Car door misalignment (part of Tier 1 selection process): Presently (2018) the NYCT system features three car geometries on the A Division and three car geometries on the B Division. With few exceptions, these cars are freely mixed between lines. The spacing of doors on these differing cars is significantly misaligned, making the installation of platform doors infeasible. Looking to the future, NYCT plans to procure new rolling stock with identical or nearly identical door spacing. The current procurement schedule indicates the purchase of these geometrically compatible cars by 2032. Therefore, our assessment of feasibility is based on the year 2032.

  However, the R line service and several overlapping services on the B Division will remain incompatible even after 2032. The R is a ten-car train, whereas the M line, which shares its route, is an eight-car train. The newer trains are assembled in two consists, with a driver / conductor cabin at the front and back of each consist. Due to the cabin, the spacing of doors on the first and last car differs from the door spacing of the other cars of the train. Therefore, there will inevitably be a mismatching of doors as these two differing train types berth at a certain station platform. The M train cannot be extended to a ten-car length because all the station stops in Brooklyn feature station platforms of an eight-car length. Please see the diagrams in Figure 1 below.

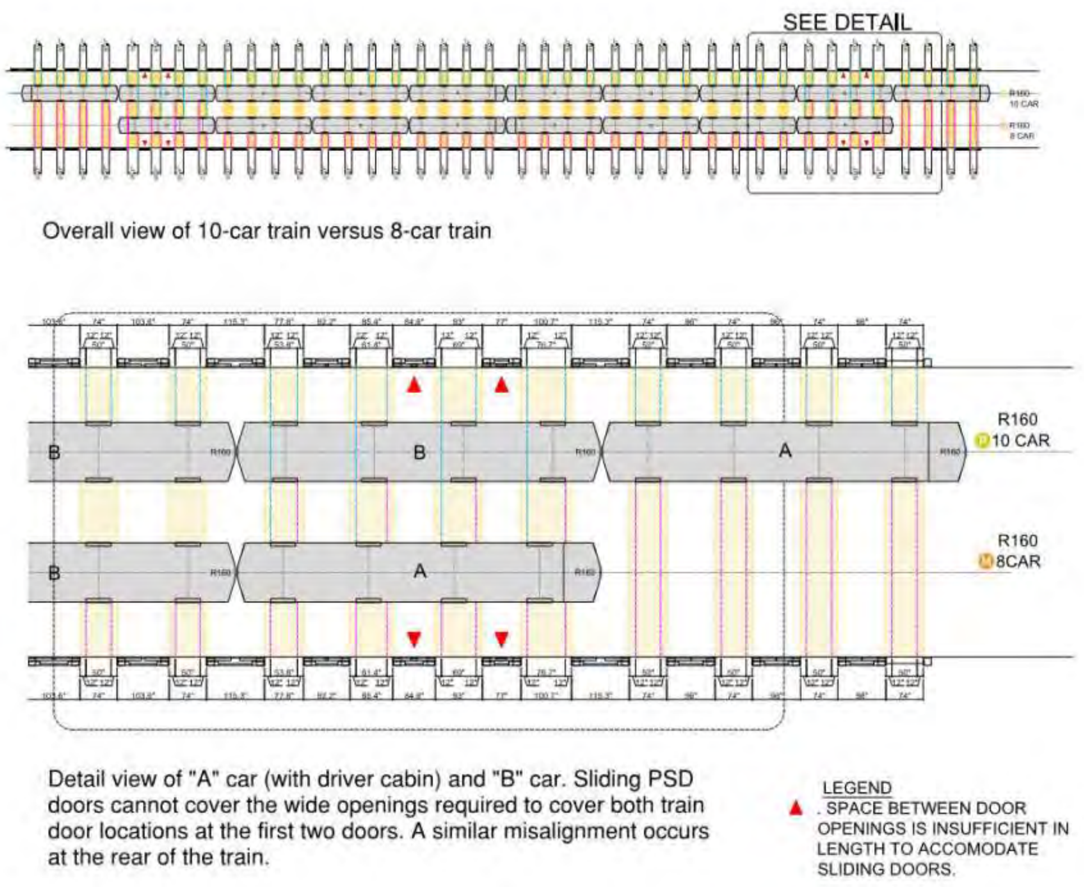

***Figure 1** – Ten-car vs. eight-car train Comparison of door geometry*

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the previously proposed 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the PSD barriers and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is used for refuse removal at the R line stations. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the (off) loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in damage from these carts along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 6% of the 'R' Line stations. Total implementation cost would be $96.1M for APGs and $123.4M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; That estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of $931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 3 feasible stations, the aggregate annual maintenance cost would be $2.8M.

Summary Table

R Service Summary of Feasibility						(6% Feasible 3/45)	
MRN No.	**Station Names**	**Station Type**	**Platform Type**	**Feasibility**	**Issues/Reason for Failure**	**Cost APGs**	**Cost PSDs**
261	Forest Hills-71 Avenue	SUB	Center/Island	No	Tier 1 Failure – train door misalignment		
262	67th Avenue	SUB	Side	No	Tier 1 Failure – train door misalignment		
263	63rd Drive Rego Pk	SUB	Side	No	Tier 1 Failure – train door misalignment		
264	Woodhaven Blvd.	SUB	Side	No	Tier 1 Failure – train door misalignment		
265	Grand Avenue	SUB	Side	No	Tier 1 Failure – train door misalignment		
266	Elmhurst Avenue	SUB	Side	No	Tier 1 Failure – train door misalignment		
267	Jackson Hts. 74th St. Roosevelt.	SUB	Center/Island	No	Tier 1 Failure – train door misalignment		
268	65th Street	SUB	Side	No	Tier 1 Failure – train door misalignment		
269	Northern Blvd.	SUB	Side	No	Tier 1 Failure – train door misalignment		
270	46th Street	SUB	Side	No	Tier 1 Failure – train door misalignment		
271	Steinway Street	SUB	Side	No	Tier 1 Failure – train door misalignment		
272	36th Street	SUB	Side	No	Tier 1 Failure – train door misalignment		
273	Queens Plaza	SUB	Center/Island	No	Tier 1 Failure – train door misalignment		
7	Lexington Ave. 59th St.	ELV	Center/Island	No	ADA Clearance		
8	5th Ave. / 59th St.	ELV	Side	Yes	-	$31.2M	$ 40.0M
9	57th Street 7th Ave	ELV	Center/Island	No	ADA Clearance		
10	49th Street	ELV	Side	Yes	-	$33.5M	$43.5M
11	Times Square 42nd Street	SUB	Center/Island	No	ADA Clearance		
12	34th Street Herald Sq.	EMB	Center/Island	No	ADA Clearance		
13	28th Street	ELV	Side	No	ADA Clearance		
14	23rd Street	ELV	Side	No	ADA Clearance		
15	14th St. Union Square	ELV	Center/Island	No	ADA Clearance		
16	8th St. NYU	ELV	Side	No	ADA Clearance		
17	Prince Street	ELV	Side	No	ADA Clearance		
18	Canal Street (UL)	ELV	Side	No	ADA Clearance		
20	City Hall	SUB	Center/Island	No	ADA Clearance		
21	Cortlandt Street	SUB	Side	No	ADA Clearance		
22	Rector Street	SUB	Side	No	ADA Clearance		
23	Whitehall St. South Ferry	SUB	Center/Island	No	ADA Clearance		
24	Court Street Montague St.	SUB	Center/Island	No	No PSD Room Location		
25	Jay St. Metrotech	SUB	Center/Island	No	ADA Clearance		
26	Dekalb Avenue Flatbush Ave	SUB	Center/Island	No	ADA Clearance		
27	Atlantic Ave. Barclays Ctr.	SUB	Center/Island	Yes	-	$31.4M	$39.9M

MRN No.	Station Names	Station Type	Platform Type	Feasibility	Issues/Reason for Failure	Cost APGs	Cost PSDs
28	Union St.	SUB	Side	No	No PSD Room Location		
29	9th Street 4th Ave	SUB	Side	No	No PSD Room Location		
30	Prospect Avenue	SUB	Side	No	No PSD Room Location		
31	25th Street	SUB	Side	No	No PSD Room Location		
32	36th Street	SUB	Center/Island	No	No PSD Room Location		
33	45th Street	SUB	Side	No	ADA Clearance		
34	53rd Street	SUB	Side	No	ADA Clearance		
35	59th Street	SUB	Center/Island	No	ADA Clearance		
36	Bay Ridge Avenue	SUB	Side	No	Column at platform edge		
37	77 Street	SUB	Side	No	Column at platform edge		
38	86 street	SUB	Center/Island	No	ADA Clearance		
39	Bay Ridge-95 Street	SUB	Center/Island	No	ADA Clearance		
					Total	**$96.1M**	**$123.4M**

1.0 Station Assessment

1.01 – MR 007 | Lexington Avenue / 59th Street Station

Summary: *Lexington Avenue / 59th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at all obstructions as the remaining width would be 30" (see figure 1).*

Description

Lexington Avenue / 59th Street Station is a below-grade station with one straight center / island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 20'-0" throughout. Columns are spaced 15' on center with column faces 4'-0" away from the platform edges. The walls at the end of platform are 45" from the platform edge. The implementation of a platform edge barrier would reduce this width to 30" or less* which would not allow for ADA compliant wheelchair movement. Please see **figure 1** for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
Lexington 59th Street Station

1.02 – MR 008 | Fifth Avenue / 59th Street Station

Summary: *Fifth Avenue / 59th Street Station is feasible for both APGs and PSDs. There is one ceiling mounted signal located at the center of each platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power capacity could not be ascertained due to inaccessibility during survey. However, a lack of adequate existing power is not considered to be a determining factor of future feasibility.*

Description

Fifth Avenue / 59th Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 3'-6" from the platform edge. The southbound platform width is approximately 11'-10" throughout. The northbound platform width is approximately 11'-6" throughout. At the center of each platform there is one ceiling mounted signal located above the platform edge, with a vertical clearance of at least 7'-6". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Ceiling mounted signals located above the platform edge would need to be relocated in the implementation of full height PSDs. **(see Figure 3)**

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting

Equipment Room

The equipment room could be located at the west mezzanine flush to the wall (see **Figure 1, Figure 2**). The proposed room dimension is 27'-0" x 6-6".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed in 1995. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, reconstruction of the concrete platform edge will be required only for the installation of an APG system.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'R' Line Stations
(Fifth Avenue / 59th Street Station)

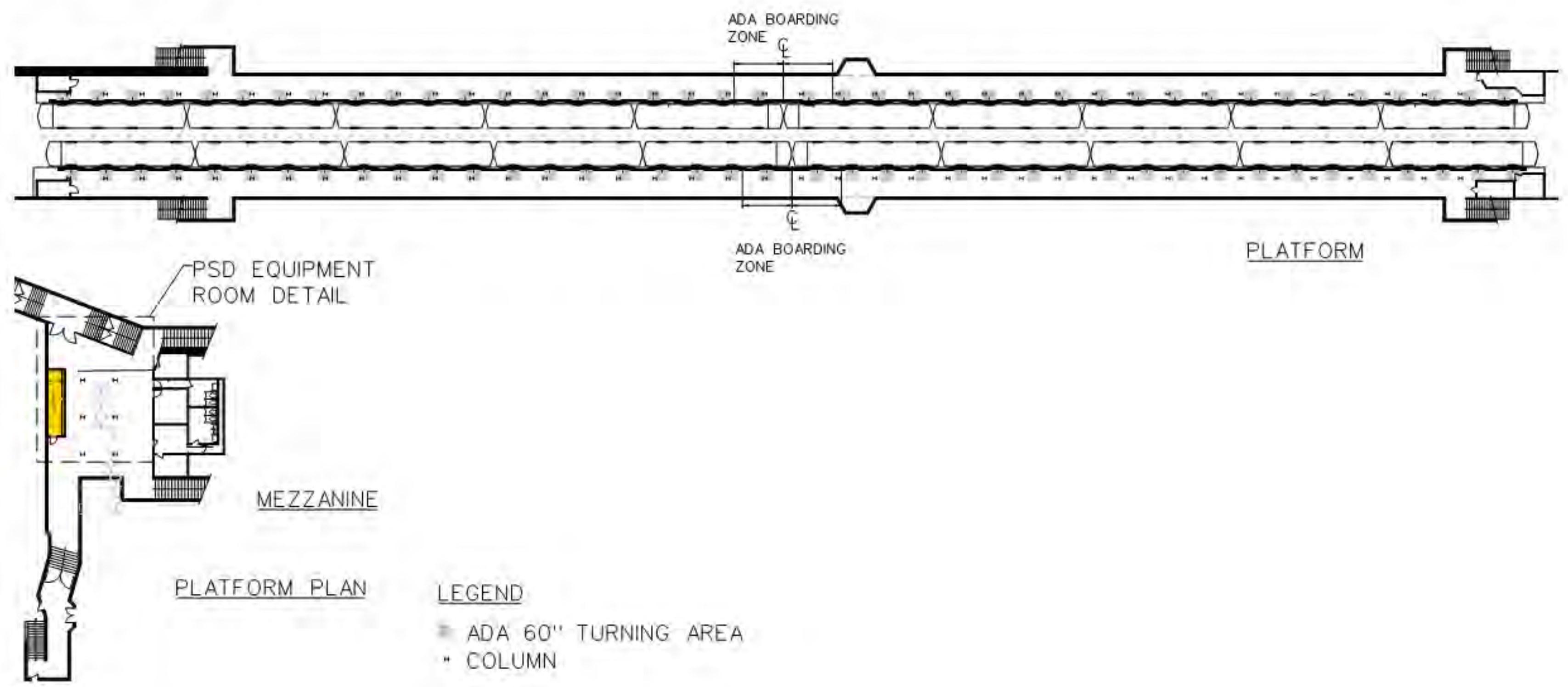

Figure 1 – Overall Station Plan
Fifth Avenue Station

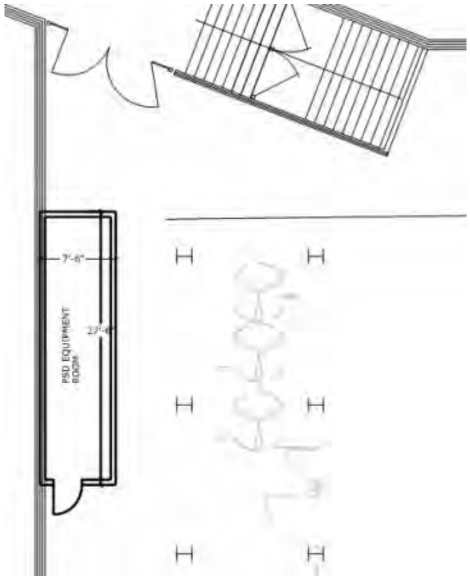

***Figure 2** – PSD Equipment Room Detail*
Fifth Avenue Station

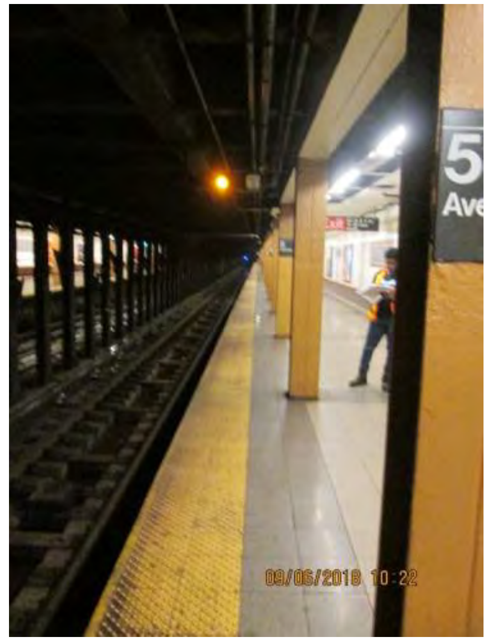

***Figure 3** – Signal above platform edge*
Fifth Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

These obstructions do not present an impediment to the installation of PSDs.

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

An analysis of adequate electrical power at this station could not be performed due to inaccessibility during survey. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Historic Restrictions:

None

Rough Order-of-Magnitude Cost Estimate:

The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions is listed in the attached ROM estimate. The total cost for this station is estimated to be $31.2M to install APGs and $40.0M to install PSDs (See Appendix E)

***Figure 4** – Typical Platform View*
Fifth Avenue Station

1.03 – MR 009 | 57th Street 7th Avenue Station

***Summary:** 57th Street 7th Avenue is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at the center stairs as the remaining width would be 27" (see figure 1).*

Description

The 57th Street Station is an underground station consisting of two center / island platforms. The platforms are approximately 19'-8" wide. The platforms are straight with two rows of columns at 42" from the edge of the platform. At four staircases columns flank the stair. The implementation of a platform edge barrier would reduce this width to 27" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-compliant ADA dimension*
57th Street Station

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1.04 – MR 010 | 49th Street Station

Summary: *49th Street Station is feasible for both APGs and PSDs. There are two ceiling mounted signals located at the center of the southbound platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). The existing power supply is adequate.*

Description

The 49th Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns on the platforms. The platform width varies from approximately 7'-0" to 14'-8". On the southbound platform there are two ceiling mounted signals located above the platform edge, with a vertical clearance of at least 7'-6". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting

Equipment Room

The equipment room could be located as a split room, with one at the south control area of the southbound, and one located at the north control area of the southbound. (see **Figure 1, Figure 2**). The proposed room dimensions are 16'-0" x 7'-6" each.

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

This platform edge was re-constructed within the last twenty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system.

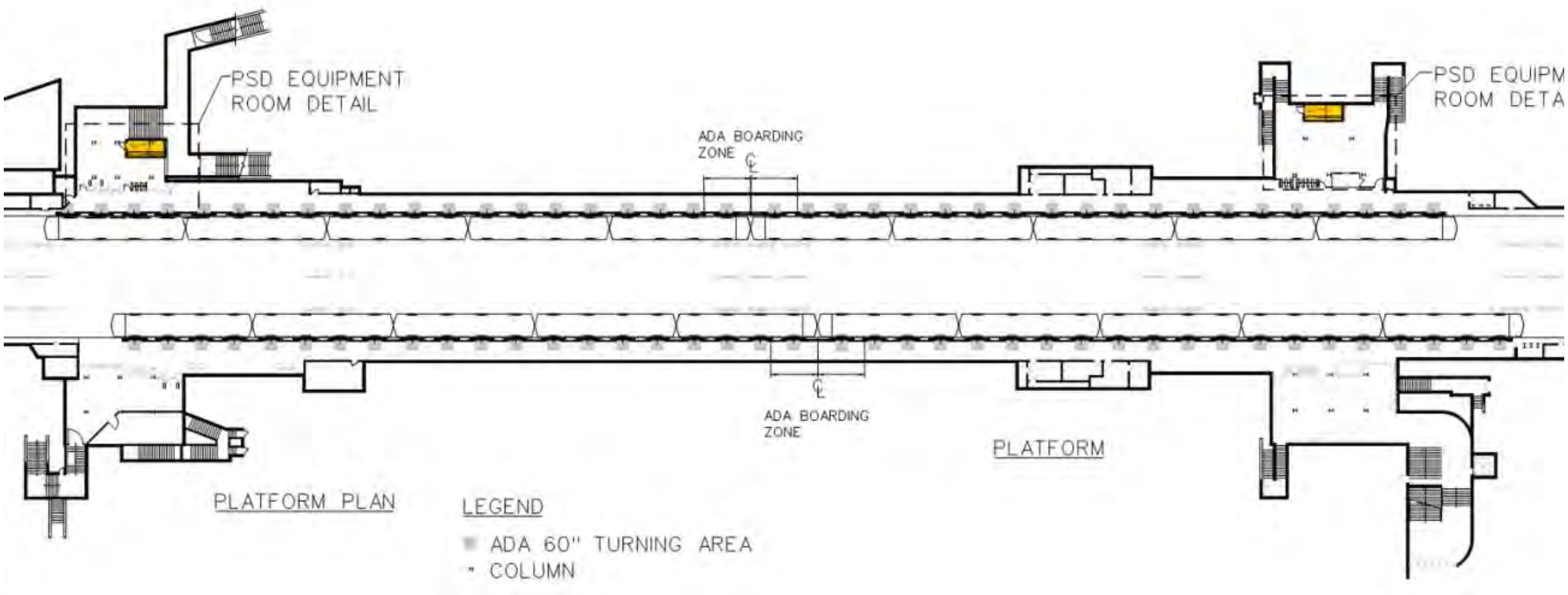

Figure 1 – Overall plan
49th Street Station

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'R' Line Stations
(49th Street Station)

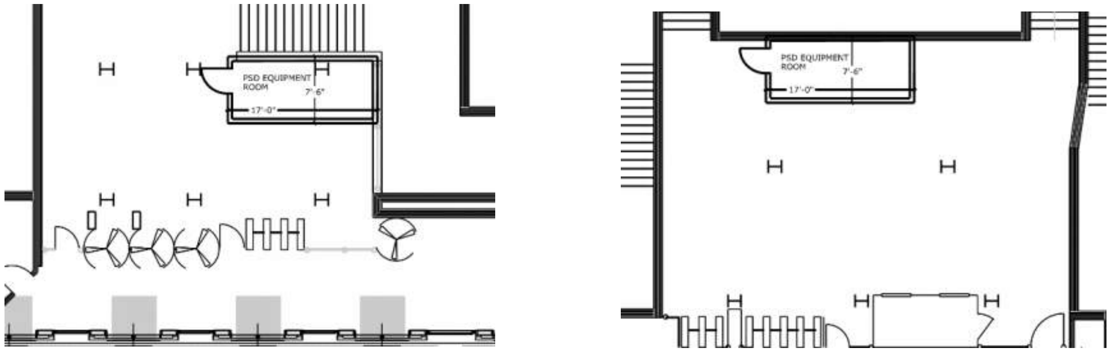

Figure 2 *– PSD Equipment Room Detail*
49th Street Station

Platform obstructions within 5' of edge:

None

Lighting:

Existing lighting: Throughout both platforms there is linear fluorescent mounted perpendicular to the platform edge in the ceiling coffers. No lighting reconfiguration will be required as part of a PSD installation.

Figure 3 *– General platform view*
49th Street Station

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 & 2 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	49th Street
Peak Demand Load from ConEd Report, Last **12** Months, (kW)	45.2
Apparent Power (kVA)	56.5
Station Peak Demand Load, Max Current, (A)	156.9
Maximum Number of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	352
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	449
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1-line diagram, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. This analysis is for **Normal service**. Meter reading is for 12 months.

Table 1. Power Capacity Analysis (Normal Service)

Station
Power Capacity Analysis

Station Name	49th Street
Peak Demand Load from ConEd Report, Last **12** Months, (kW)	27.2
Apparent Power (kVA)	34.0
Station Peak Demand Load, Max Current, (A)	94.5
Maximum Number of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	289
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	511
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1-line diagram, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. This analysis is for **Reserve service**. Meter reading is for 12 months.

Table 2. Power Capacity Analysis (Reserve)

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions is listed in the attached ROM estimate. The total cost for this station is estimated to be $33.5M to install APGs and $43.5M to install PSDs (See Appendix E)

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1.05 – MR 011 | Times Square / 42nd Street Station

Summary: *Times Square / 42nd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 19" (see figure 1). (Note: this report covers only the Broadway BMT platforms; see reports for the Shuttle, 7, 1,2,3-line for the remainder of the station)*

Description

Times Square / 42nd Street Station is a below-grade station consisting of two center / island platforms. The platform width is 19-4" throughout. The platforms are straight with two rows of columns at 3'-8" from edge of platform. At the south end of the platforms, the columns flanking an equipment room are 2'-10" from the platform edge. The implementation of a platform edge barrier would reduce this width to 19" or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains

***Figure 1** – Non-Compliant ADA condition*
42nd Street / Times Square Station

1.06 – MR 012 | 34th Street / Herald Square Station

Summary: *34th Street / Herald Square Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1). (Note: this report covers only the Broadway BMT platforms; see the B, D, F, M-line report for the remainder of the station)*

Description

34th Street / Herald Square Station is a below-grade station consisting of two center / island platforms. The platform width is 19'-8" throughout. The platforms are straight with two rows of columns at 3'-4" from edge of platform. On the center / island platform the columns flank multiple staircases. The implementation of a platform edge barrier would reduce this width to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains

***Figure 1** – Non-Compliant ADA condition*
34th Street Station

1.07 – MR 013 | 28th Street Station

***Summary:** 28th Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

28th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns 3'-6" from the platform edge at each platform, though approximately one third of the platform is column-free. The platform width varies from 6'-0" to 9'-5. Due to the extremely limited width of the existing platforms and control areas, there is no available space for the equipment room. Figure 2, below, shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the southbound control area. The northbound control area is similar..

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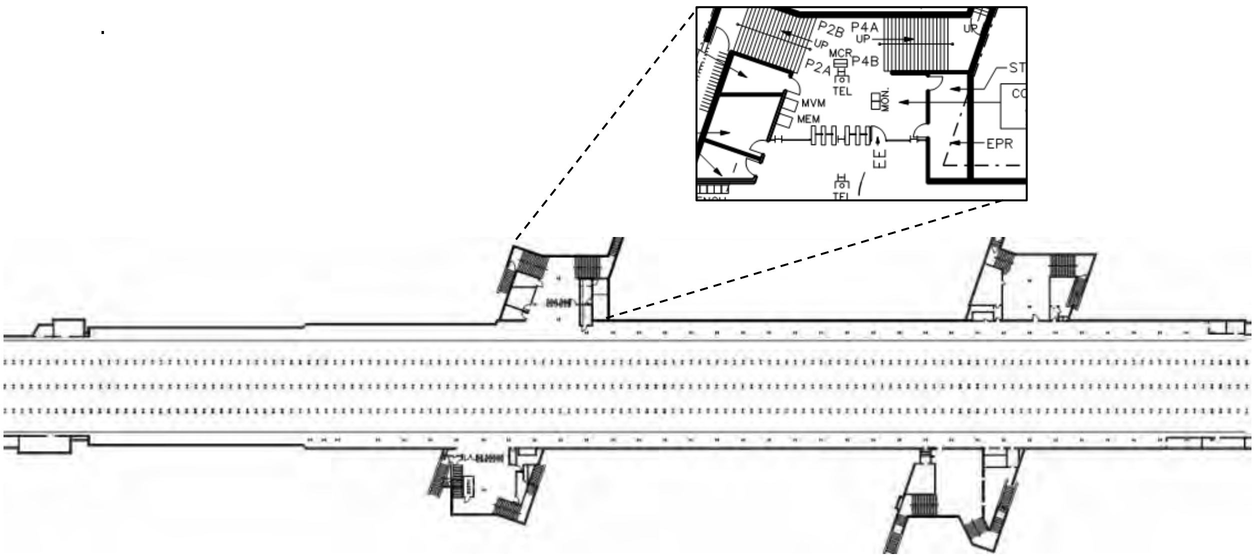

***Figure 1** – Station Plan- 28th Street Station*

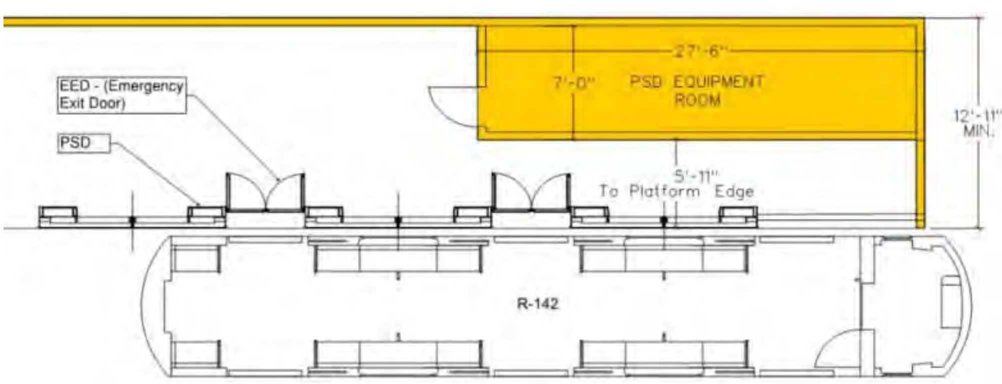

***Figure 2 –** Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimensions)

1.08 – MR 014 | 23rd Street

Summary: *23rd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at the northbound platform control area as the remaining width would be 27" (see figure 1).*

Description

23rd Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns 3'-8" from the platform edge at each platform. The platform width varies from 6'-0" to 11'-2" in width. The entry / exit turnstiles at the south entrance of the northbound platform are positioned with minimal clearance of 18" to the adjacent columns. The remaining space between the columns and the platform edge measures 42". The implementation of a platform edge barrier would reduce this width to 27" or less* which would not allow for ADA compliant wheelchair movement. See figures 1and 2 below. The plan in figure 1 demonstrates that there is no alternative location for the turnstiles / railings.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

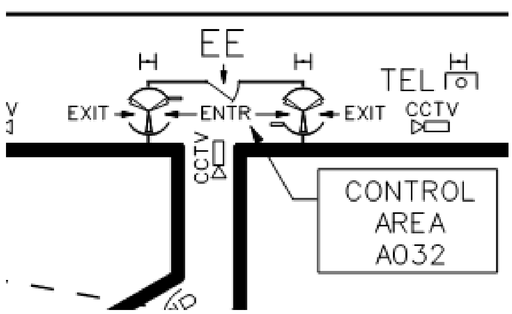

***Figure 1** – Non-Compliant ADA condition - 23rd Street*

***Figure 2** – Non-Compliant ADA condition*
23rd Street

1.09 – MR 015 | 14th Street / Union Square Station

Summary: *14th Street / Union Square Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 27" (see figure 1). (Note: this report covers only the Broadway BMT platforms; see reports for the L-line and 4,5,6-line for the remainder of this complex)*

Description

14th Street / Union Square Station is a below-grade station consisting of two center / island platforms. The platform width is 18-8" throughout. The platforms are straight with two rows of columns at 3'-6" from edge of platform; these columns flank multiple staircases. The implementation of a platform edge barrier would reduce this width to 27" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
14th Street / Union Square

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1.10 – MR 016 | 8th Street Station

Summary: *8th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1).*

Description

8th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns 3'-4" from the platform edge at each platform. The platform width varies from 9'-6" to 11'-0" in width. The south street stair at each platform is positioned with minimal clearance to the adjacent columns. The remaining space between the columns and the platform edge measures 40". The implementation of a platform edge barrier would reduce this width to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 below.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
8th Street Station

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1.11 – MR 017 | Prince Street Station

Summary: *Prince Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 21" (see figure 1).*

Description

Prince Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 7'-6' to 8'-8". Platform width at the south end of the southbound platform is 36". The implementation of a platform edge barrier would reduce this width to 21" or less* which would not allow for ADA compliant wheelchair movement.. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
Prince Street

1.12 – MR 018 | Canal Street Station Upper Level

Summary: *Canal Street is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 33" (see figure 1).*

Description

Canal Street Station (upper level) is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 7'-0' to 11'-8". Platform width at the south end of the northbound platform is 48". The implementation of a platform edge barrier would reduce this width to 33" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
Canal Street Station

1.13 – MR 020 | City Hall Station

Summary: *City Hall Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1).*

Description

City Hall Station is a below-grade station with a center / island platform. The platform structure is cast-in-place concrete. The platform width varies from 23'-8" to 46'-4". There are four lines of columns, with those adjacent to the track being 3'-4" from the platform edge. Ceiling heights measure no less than 7'-6" throughout. At the stair to the lower level, clearance along the platform edge is constricted by columns subdividing the space into two narrow widths. The available 40" width between columns and platform edge will be further constricted by the introduction of PSDs, reducing the width to 25" or less* which would not allow for ADA compliant wheelchair movement. See Figure 1 below.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
City Hall Station

1.14 – MR 021 | Cortlandt Street Station

Summary: *Cortlandt Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the northbound platform as the existing width is 5'-3"" (see figure 1).*

Description

Cortlandt Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-3' to 19'-8". There are two ceiling-mounted signals at each platform at a minimum 6'-11" clearance.

Platform width at the south end of the northbound platform is 5'-3". The installation of a platform edge barrier will reduce the width to 48" or less*. Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress with an installed PSD system. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant code condition*
Cortlandt Street Station

1.15 – MR 022 | Rector Street Station

Summary: *Rector Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at the northbound control area as the remaining width would be 25" (see figure 1).*

Description

Rector Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 10'-2' to 11'-8". At the turnstile line on the northbound platform, clearance between the turnstiles and the row of columns is only 20". At this area there is 40" between the columns and the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 32" for a pinch point. The remaining 25" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference. The plan of this area shown in Figure 2 reveals the constrained conditions within the unpaid area and demonstrates that there is no available space for reconfiguration of turnstiles to ameliorate the non-compliant conditions.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant code condition*
Rector Street Station

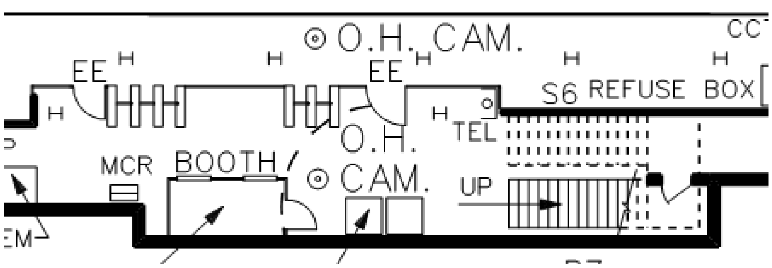

Figure 2 *– Constrained control area; northbound platform*
Rector Street Station

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1.16 – MR 023 | Whitehall Street Station

Summary: *Whitehall Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 21" (see figure 1).*

Description

Whitehall Street Station is an underground station consisting two center / island platforms. The platforms are approximately 12'-6" wide throughout. At four staircases, columns flank the stair, leaving a dimension of 36" between the column and the platform edge. The implementation of a platform edge barrier would reduce this width to 21" or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
Whitehall Street Station

1.17 – MR 024 | Court Street Station

Summary: *Court Street is not feasible for both APGs and PSDs as the columns which are located 16" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors. (see figure 1).*

Description

The Court Street Station is a below grade station with a center / island platform. The platform structure is cast-in-place concrete. The width of the platform varies from 15'-2" to 19'-2". Several columns are 16" from the platform edge. In that position, the columns block access to the maintenance panels of the PSDs. In addition, the columns impede the ability to open the hinged emergency egress doors which are mounted between every PSD sliding door. **(see Figure 1)**.

Figure 1 – *Obstruction at platform edge*
Court Street Station

1.18 – MR 025 | Jay Street / Metrotech Station

Summary: *Jay Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36” minimum corridor width and the 32” minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 9” (see figure 1).*

Description

The Jay Street Station is a below grade station with a center / island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 14’-0” throughout. Columns are spaced 13’-0” on center. There is one staircase along the platform adjacent to these columns. The column faces are 24” away from all platform edges. The implementation of a platform edge barrier would reduce this width to 9”” or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. **(see Figure 1)**.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Non-Compliant ADA condition*
Jay Street Station

1.19 – MR 026 | Dekalb Ave Station

Summary: *Dekalb Ave Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" pinch point requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 29" (see figure 1).*

Description

Dekalb Ave Station is a below-grade station with two center / island platforms. The platform structures are cast-in-place concrete. The platform columns are spaced 10'-10" on center, and column faces typically measure 3'-8" from the platform edge. The platform width is 15'-8" throughout. At the platform staircases, the columns flanking the stairs measure 3'-8" from the platform edge and are touching the staircase. The implementation of a platform edge barrier would reduce the currently compliant width of 44" to 29" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

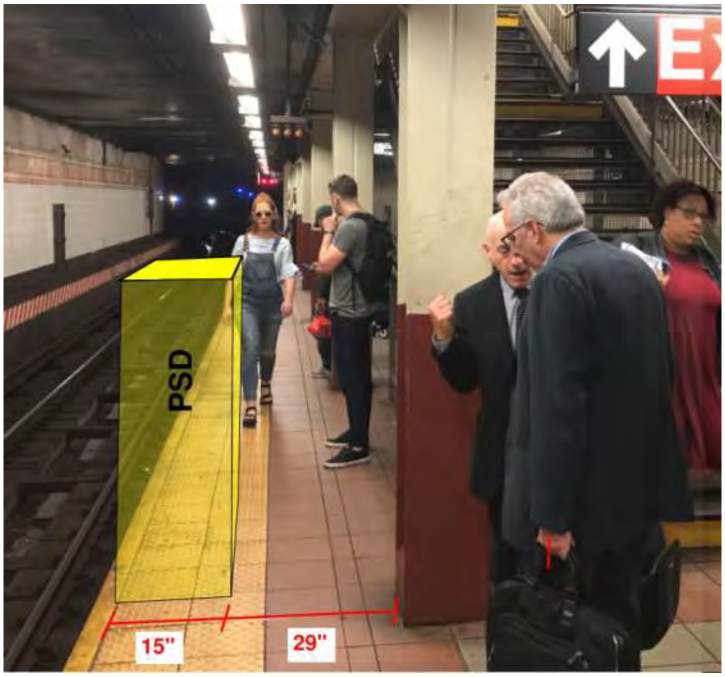

Figure 1 *– Non-Compliant ADA condition Dekalb Avenue Station*

1.20 – MR 027 | Atlantic Ave Station

Summary: *Atlantic Ave Station is feasible for both APGs and PSDs. At the southbound platform, two columns adjacent to the platform edge would require removal and replacement at a more distant location. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

Atlantic Ave Station is a below grade with two side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. The platform columns are spaced 15'-1/2" on center, and column faces are at varying distances from the platform edge. The platform width is 18'-8" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be in coordination with existing or replacement lighting.

Equipment Room

Since there are 4 platform edges at this station, 2 full size equipment rooms would be required. The equipment rooms could be located at the south mezzanine. (**Figure 1 & Figure 2).** The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

This platform edge was re-constructed within the last thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system.

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 'R' Line Stations
(Atlantic Ave Station)

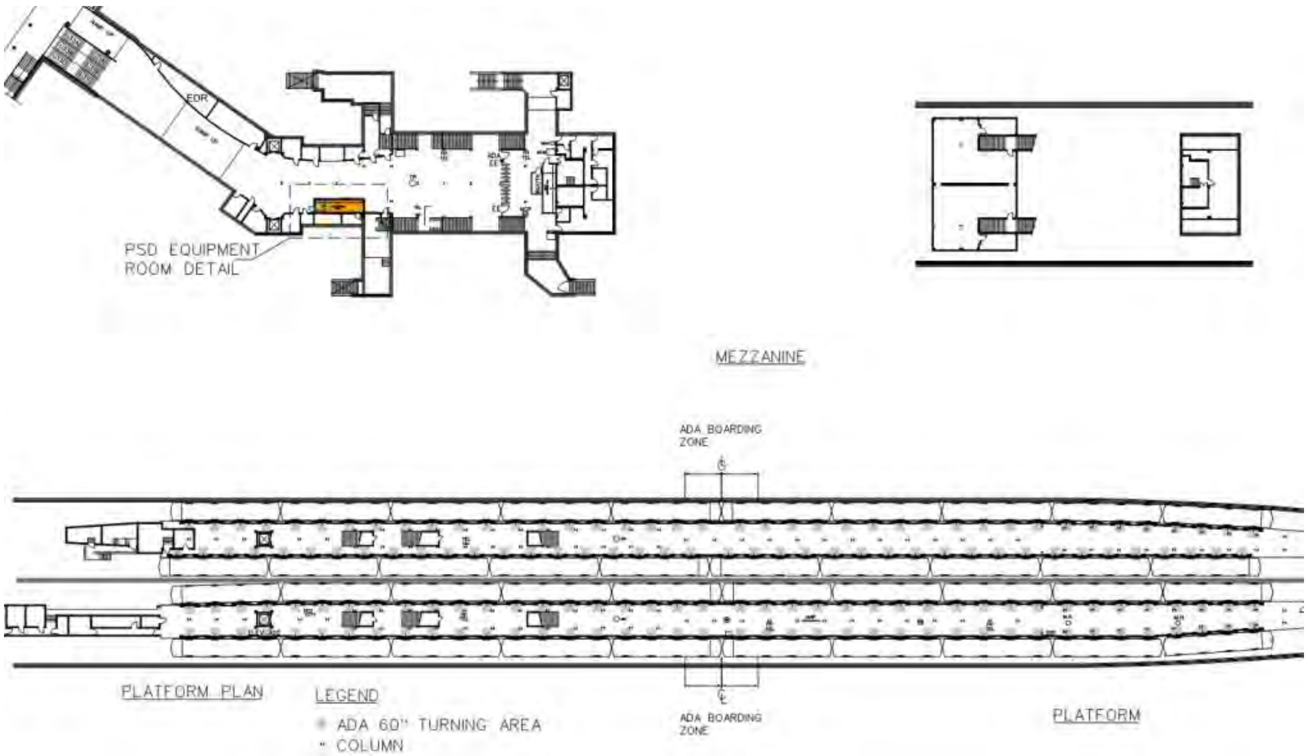

Figure 1 *– Overall Station Plan*
Atlantic Ave Station

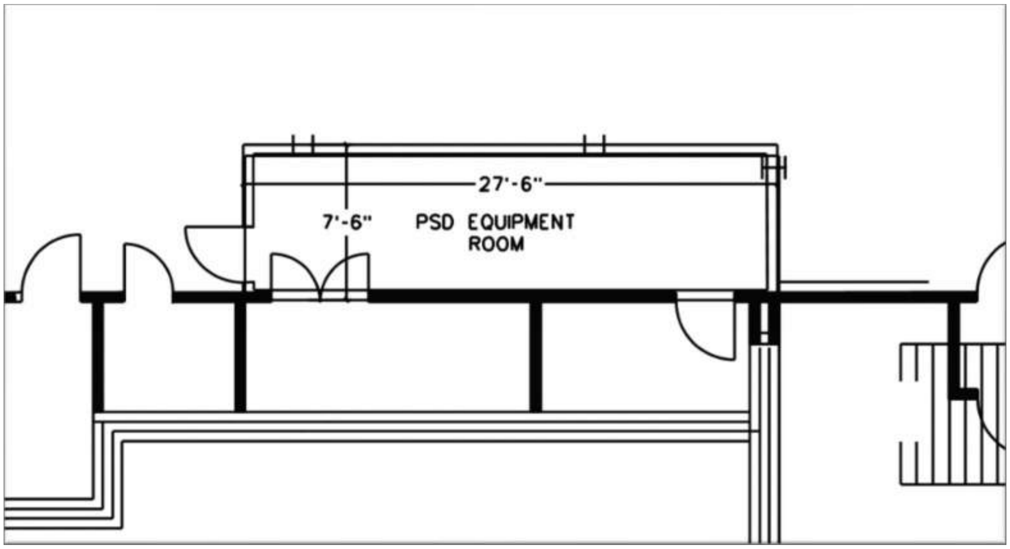

Figure 2 *– PSD Equipment Room 1 Detail*
Atlantic Ave Station

Platform obstructions within 5' of edge:

Southbound Track:

- One column is at 1'-0" from each platform edge. They will require removal and replacement as part of any PSD installation.

Northbound Track:

- None

These obstructions do not present an impediment to the installation of PSDs beyond the instances mentioned above.

Historic Restrictions:

The Atlantic Avenue station is a historically designated property. As such, design will require review by the New York State Historical Preservation Office.

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis

Station Name	Atlantic Ave. Barclays Ctr.
Peak Demand Load from ConEd Report, (kW)	88.8
Apparent Power (kVA)	111.0
Station Peak Demand Load, Max Current, (A)	308.3
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	649
Station Service Power Capacity, (Main SB or SG Rating), (A)	1600
Service Spare Capacity, (A)	951
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 1600A fuses at Service switch. Station has (2) separate meter readings each for Normal & Reserve service. This analysis is for **Normal service**.

Table 1- *Power Capacity Analysis (Normal Service)*

Station Power Capacity Analysis

NYCT Station MR Number	27
Station Name	Atlantic Ave. Barclays Ctr.
Peak Demand Load from ConEd Report, (kW)	55.2
Apparent Power (kVA)	69.0
Station Peak Demand Load, Max Current, (A)	191.7
Maximum Amount of Doors	160.0
PSD Total Load Including All Miscellaneous Loads, (A)	340.6
Total Load (Station Peak + PSD), (A)	532
Station Service Power Capacity, (Main SB or SG Rating), (A)	1600
Service Spare Capacity, (A)	1068
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 1600A fuses at Service switch. Station has (2) separate meter readings each for Normal & Reserve service. This analysis is for **Reserve service**.

Table 1- *Power Capacity Analysis (Reserve Service)*

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.3M to install APGs and $39.9M to install PSDs (See Appendix E).

***Figure 3** – View of column at platform edge requiring removal and replacement*
Atlantic Ave Station

1.21 – MR 028 | Union Street Station

Summary: *Union Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

Union Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns 2’-6” from the platform edge at each platform, at the northern third of the stations. The remainder of the platform is column-free. The platform width is 8’-8” throughout. Due to the extremely limited width of the existing platforms and control areas, there is no available space for the equipment room. Figure 2 below shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the northbound control area. The southbound control area is similar.

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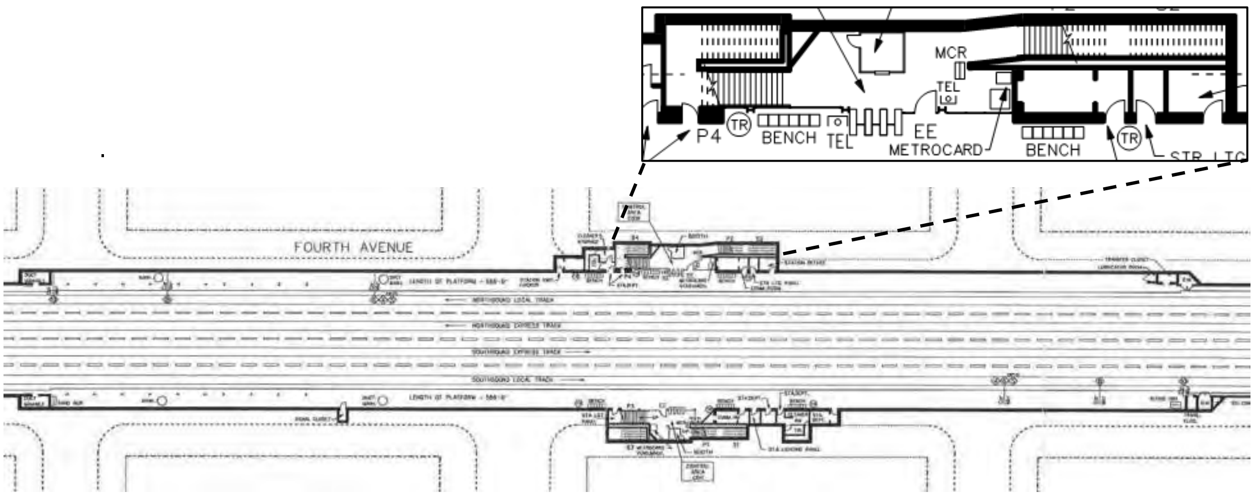

Figure 1 – *Congested/Narrow Station Plan*
Union Street Station

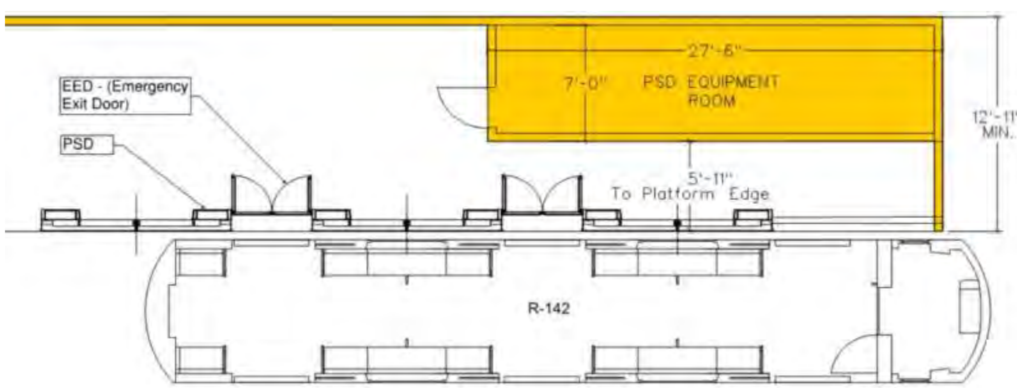

Figure 2 – *Diagram demonstrating minimum platform width dimensions*
Union Street Station

1.22 – MR 029 | 4th Ave / 9th St Station

Summary: *4th Ave / 9th St Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

4th Ave 9th St Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 8'-4" to 8'-8"." Columns are spaced 11'-10" on center with column faces 3'-0" away from the edge. The columns are present only on the northern third of both the platforms; the remainder of the platforms are column-free. Due to the extremely limited width of the existing platforms and control areas, there is no available space for the equipment room. Figure 2, below, shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the northbound control area. The southbound control area is similar.

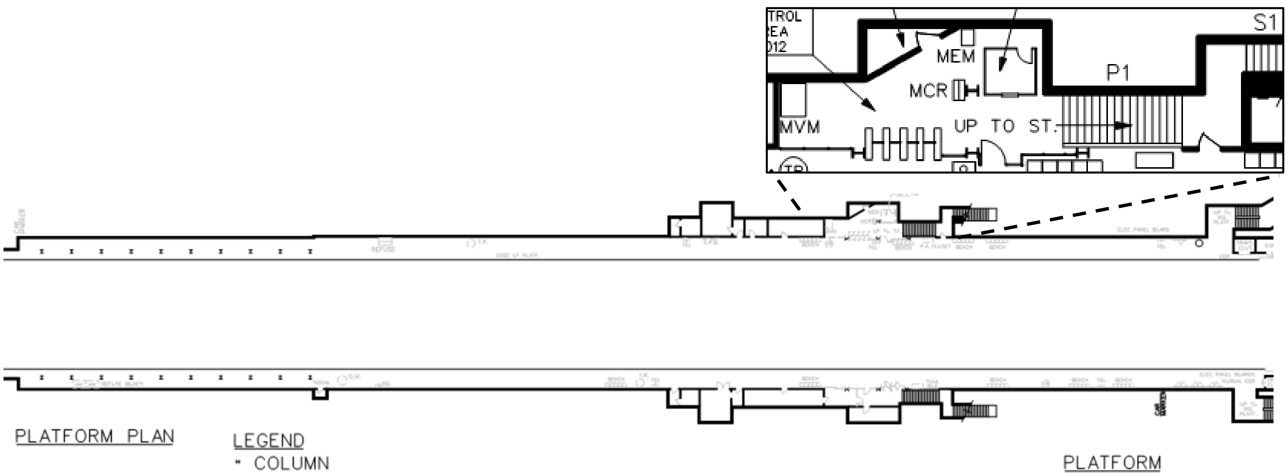

Figure 1 – *Congested/Narrow Station Plan*
4th Ave / 9th Street Station

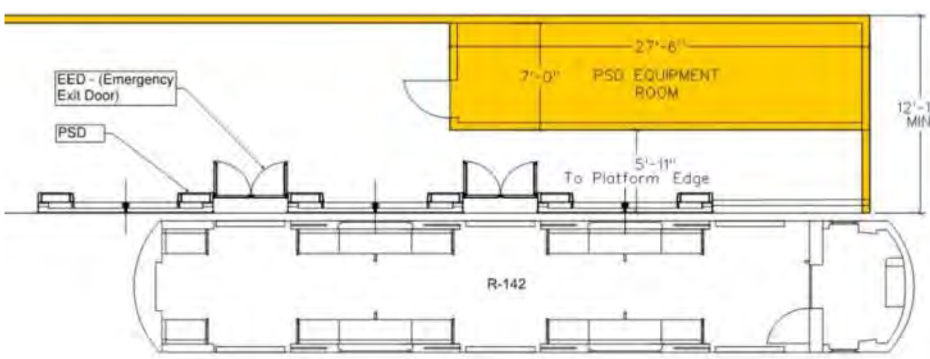

Figure 2 – *Diagram demonstrating minimum platform width dimensions*
4th Ave / 9th Street Station

1.23 – MR 030 | Prospect Avenue Station

Summary: *Prospect Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

The Prospect Ave Station is a below-grade station with two side platforms. The platform structure is cast-in-place concrete. The width of the platform is approximately 8'-4" throughout. Columns occupy only the northern third of the platforms with column faces 2'-4" away from the platform edge. Due to the extremely limited width of the existing platforms and control areas, there is no available space for an equipment room. Figure 2, below, shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the northbound control area. The southbound control area is similar.

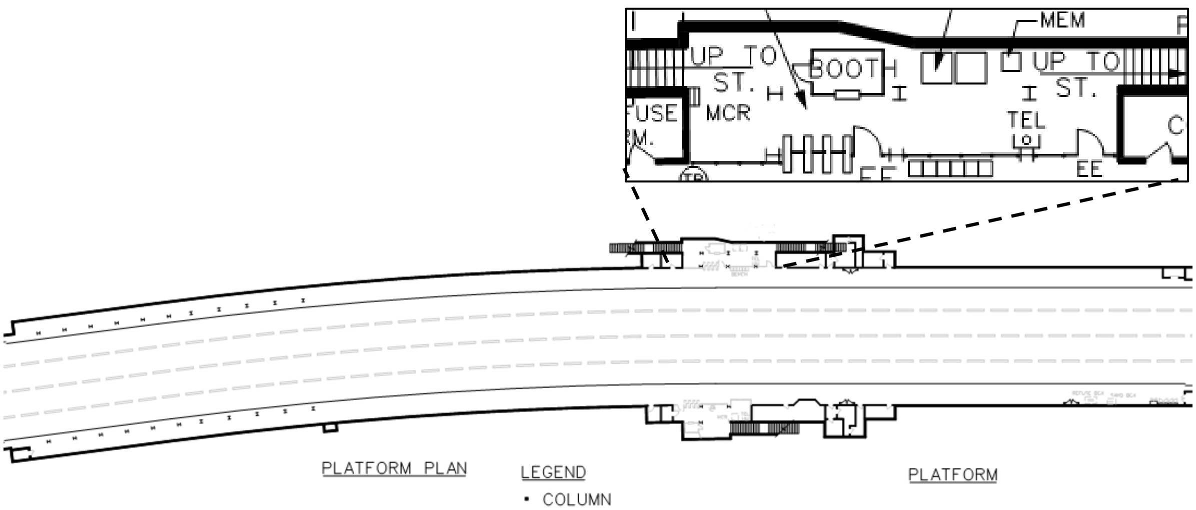

***Figure 1** – Congested/Narrow Station Plan*
Prospect Avenue Station

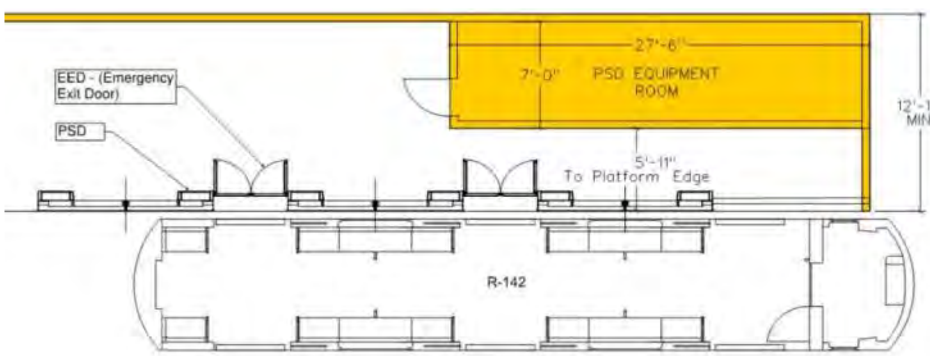

***Figure 2** – Diagram demonstrating minimum platform width dimensions*
Prospect Avenue Station

1.24 – MR 031 | 25th Street Station

Summary: *25th Street is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

25th Street Station is a below grade station with two side platforms. The platform structure is cast-in-place concrete. The width of the platform is approximately 8'-4" throughout. Columns occupy only the northern third of the platforms with column faces 2'-4" away from the platform edge. Due to the extremely limited width of the existing platforms, there is no available space for an equipment room. Figure 2, below, shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the northbound control area. The southbound control area is similar.

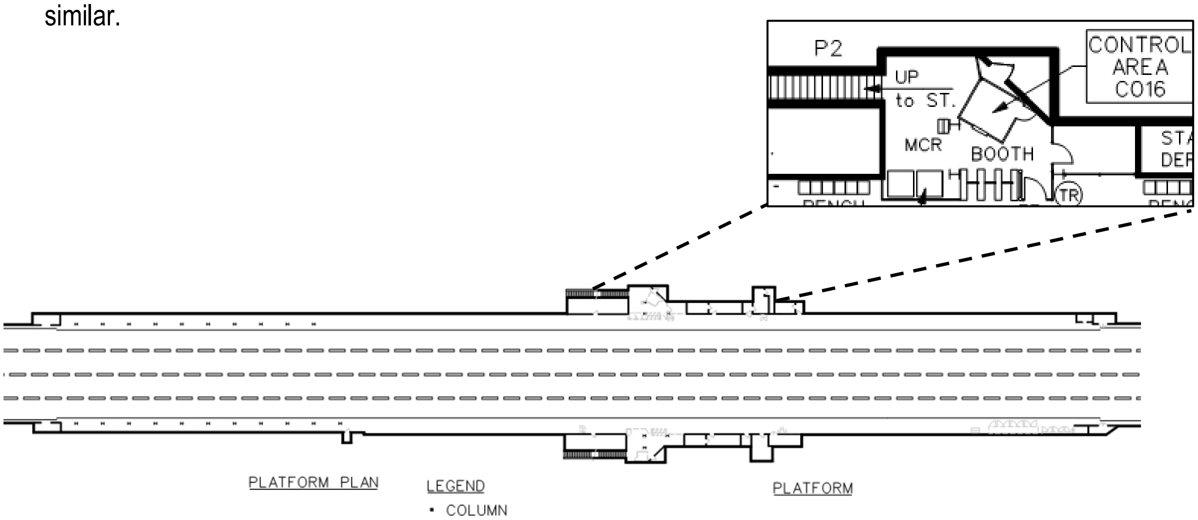

***Figure 1** – Congested/Narrow Station Plan*
25th Street Station

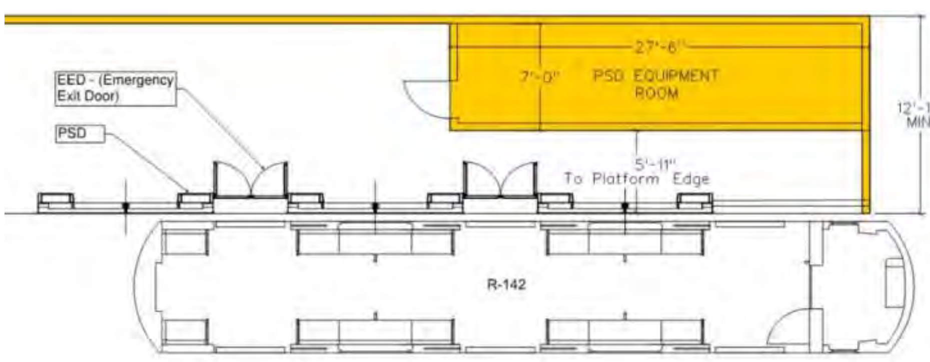

***Figure 2** – Diagram demonstrating minimum platform width dimensions*
25th Street Station

1.25 – MR 032 | 36th Street Station

Summary: *36th Street Station is not feasible for both APGs and PSDs as the columns which are located 12" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors. (see figure 1).*

Description

The 36th Street Station is a below grade station with two center / island platforms. The platform structure is cast-in-place concrete. The width of the platforms varies from 13'-0" to 19'-2". The station is not feasible for both APGs and PSDs due to the presence of structural columns located on the station platforms which are within the envelope that the proposed PSD system(s) would occupy. Due to the position of columns at 12" or less from the platform edge, installation and maintenance cannot be carried out for lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios. **(see Figure 1)**.

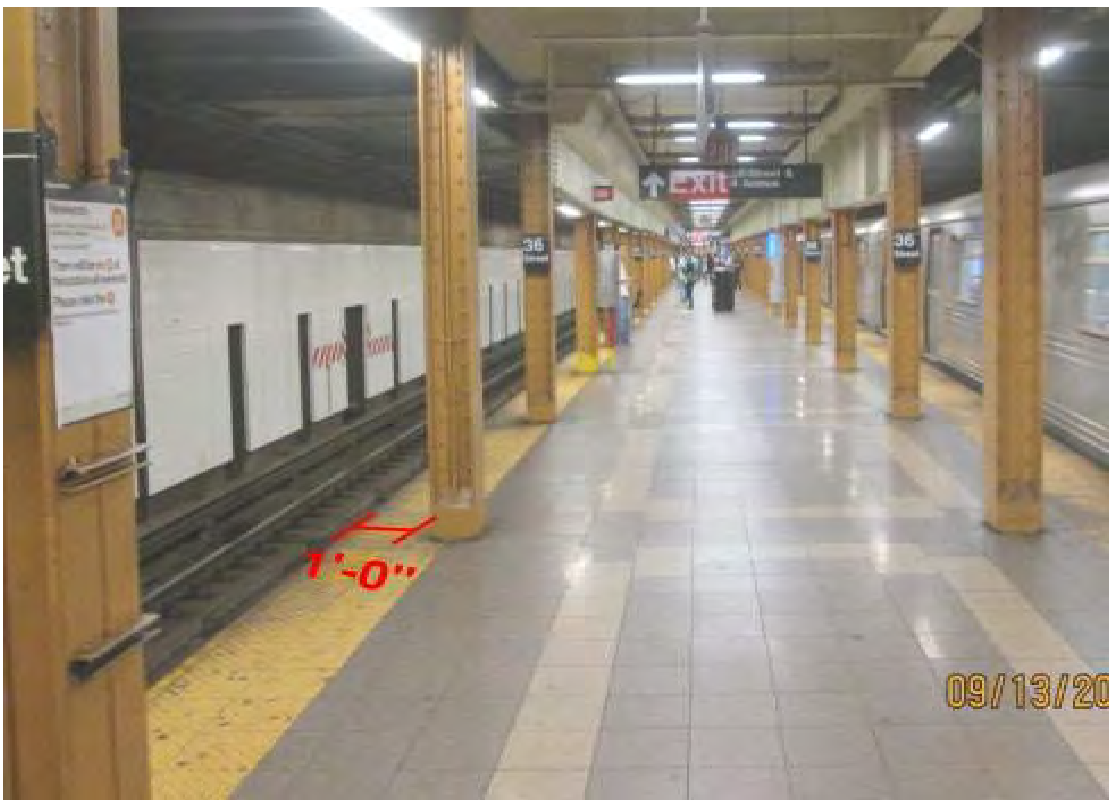

Figure 1 – *Obstruction within 12"*
36th Street

1.26 – MR 033 | 45th Street Station

Summary: *45th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs/walls as the remaining width would be 25" (see figure 1).*

Description

The 45th Street Station is a below grade station with two side straight platforms. The platform structure is cast-in-place concrete. The width of the platform varies 10'-8" to 15'-6". There is one room along the southbound platform which would constrain wheelchair movement with PSDs installed. Columns are spaced 15'-6" on center with column faces 3'-0" away from all platform edges. The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 25" or less* would not allow for ADA compliant wheelchair movement. **(see Figure 1)**.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Non-Compliant ADA condition*
45th Street Station

1.27 – MR 034 | 53rd Street Station

Summary: *53rd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs/wall as the remaining width would be 23" (see figure 1).*

Description

The 53rd Street Station is a below grade station with two side straight platforms. The platform structure is cast-in-place concrete. The width of the platform varies 9'-6" to 10'-10". There is one staircase along the southbound platform which would constrain wheelchair movement with PSDs installed. Columns are spaced 15'-2" on center with column faces 3'-2" away from all platform edges. The implementation of a platform edge barrier would reduce this width below the required minimum of 32". The remaining 23" or less* would not allow for ADA compliant wheelchair movement nor regular passenger movement. **(see Figure 1)**.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 – *Non-Compliant ADA condition*
53rd Street Station

1.28 – MR 035 | 59th Street Station

Summary: *59th Street Station not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 33" (see figure 1).*

Description

The 59th Street Station is a below grade station with two center / island platforms. The platform structure is cast-in-place concrete. The width of the platform is varying 12'-8" to 17'-10". There is one staircase along the southbound platform which would constrain wheelchair movement with PSDs installed. Columns are spaced 15'-1" on center with column faces 3'-0" away from all platform edges. The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 33" or less* would not allow for ADA compliant wheelchair movement. **(see Figure 1)**.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

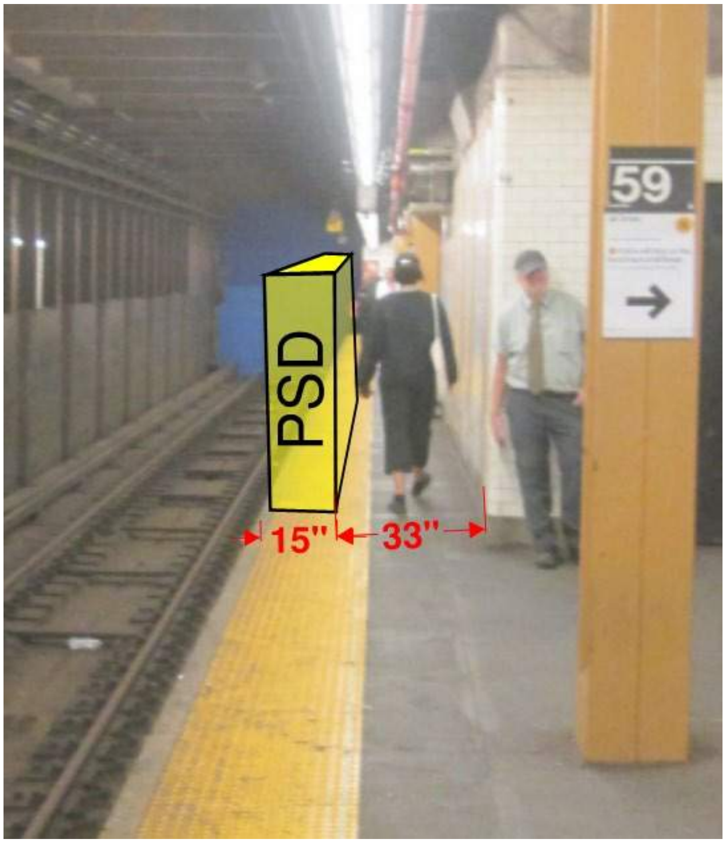

Figure 1 – *Non-Compliant ADA condition*
59th Street Station

1.29 – MR 036 | Bay Ridge Avenue Station

Summary: *Bay Ridge Avenue Station is not feasible for both APGs and PSDs as the columns which are located 14" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

Bay Ridge Avenue Station is not feasible for both APGs and *PSDs* due to the presence of structural columns located on the station platforms which are within the envelope that the proposed PSD system(s) would occupy. Due to the position of columns at 14" or less from the platform edge, installation and maintenance cannot be carried out for lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

Figure 1 – *Column 1'-2" from the edge*
Bay Ridge Avenue Station

1.30 – MR 037 | 77th Street Station

Summary: *77th Street Station is not feasible for both APGs and PSDs as the columns which are located 14" from the platform edge would impede both access for maintenance and the ability to egress the train through the hinged emergency exit doors.*

Description:

77th Street Station is not feasible for both APGs and *PSDs* due to the presence of structural columns located on the station platforms which are within the envelope that the proposed PSD system(s) would occupy. Due to the position of columns at 14" or less from the platform edge, installation and maintenance cannot be carried out for lack of clear space. Furthermore, egress doors installed on an APG/PSD system would be obstructed by the present columns. Altering the proposed APG/PSD system to adapt to the existing conditions or relocating the present structural columns pose cost prohibitive scenarios.

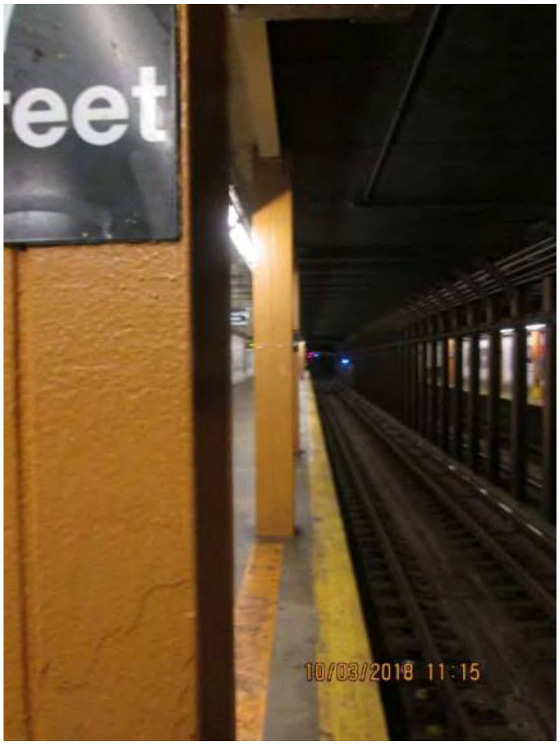

Figure 1 – *Columns 1'-2" from the edge*
77th Street Station

1.31 – MR 038 | 86th Street Station

Summary: *86th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 33" (see figure 1).*

Description

86th Street Station is a below-grade station with one center/island platforms. The platform structure is cast-in-place concrete. The width of the platform is approximately 18'-8" throughout. The platform width between the platform edge and a station facility room is 48". The implementation of a platform edge barrier would reduce this width below the required minimum corridor width of 36". The remaining 33" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1 –** Non compliant ADA Condition*
86th Street Station

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1.32 – MR 039 | 95th Street Station

***Summary**: 95th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 21" (see figure 1.*

Description

95th Street Station is a below-grade station consisting of one center/island platform. The platform width is approximately 16'-1" throughout. The platform is straight with two rows of columns approximately 3'-1" from the edge of platform. Columns at the ejector room at the north end of the platform measure 36" from the platform edge. The implementation of a platform edge barrier would reduce this width to 21" or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains

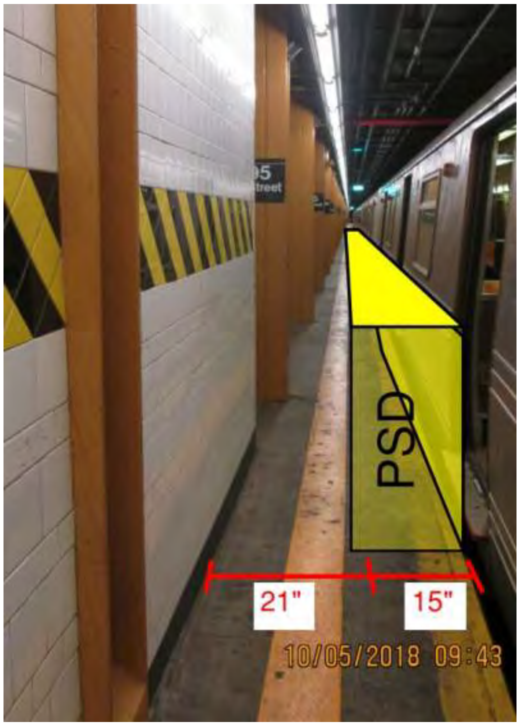


***Figure 1 –** Column 1'-2" from the edge*
95th Street Station

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*
>
> *a. Column location in relation to the platform edge*
> *b. Platform edge clearance adjacent to stairs and other impediments*
> *c. Impacts to ADA path of travel and boarding areas*
> *d. Conflicts of PSD/APG/RPSDs with Signals cables*
> *e. Sufficient platform width*
> *f. Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*
>
> *a. Structural capacity of platforms to accept PSD/APG/RPSDs*
> *b. Feasibility & location for PSD/APG/RPSDs equipment room*
> *c. Confirmation of adequate power for PSD/APG/RPSDs*
> *d. Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> *e. Determination of communications requirements, availability and cost*
> *f. Determination of gap detection and entrapment avoidance technology requirements*
> *g. Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.

k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.

l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
    - Double the amount of motors as PSDs (each motor operating a single leaf).
    - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
    - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
    - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY. Status of doors will be provided to crew via indicator lights, with no automated propulsion cutout.

If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	**Dedicated Loop**	**Wayside Only**
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

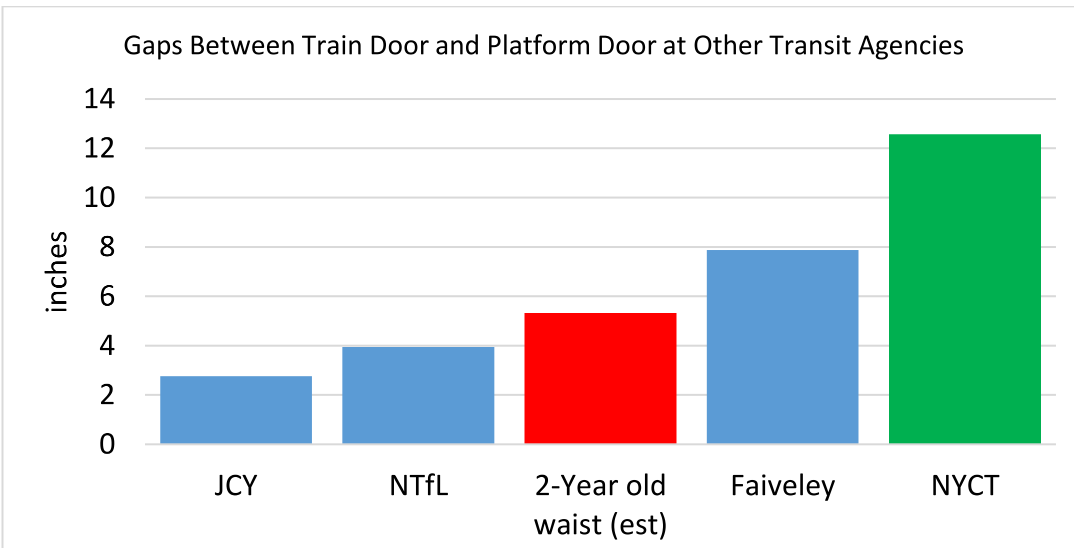


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

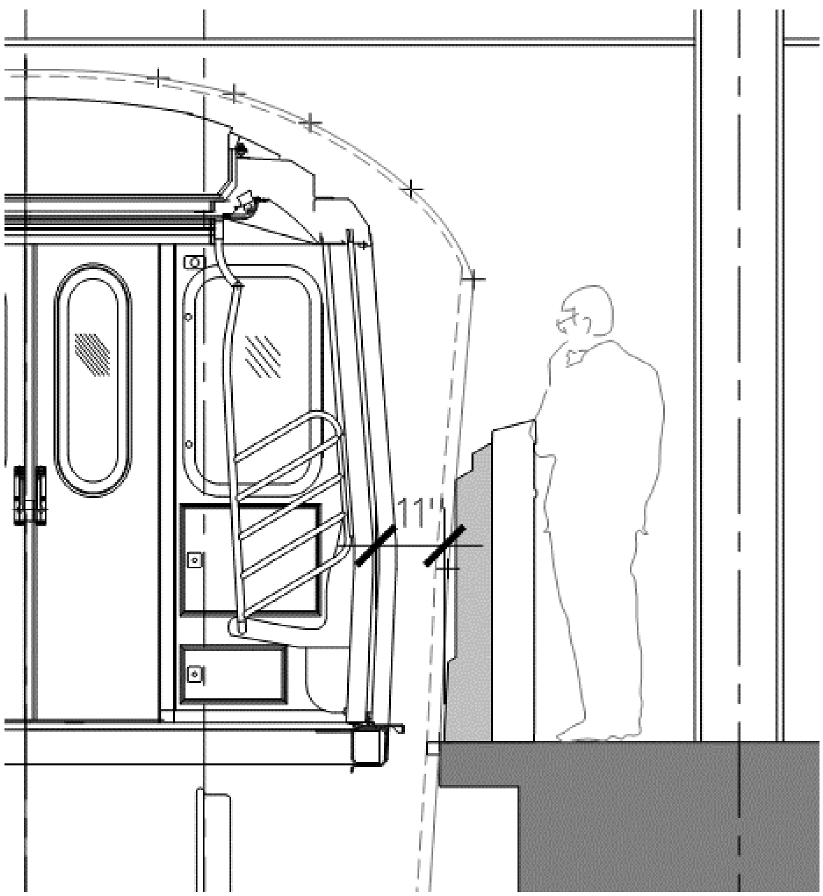


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

Impact per station

2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

Impact per station

3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber "bumpers" on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6" into the line equipment envelope. This would leave a 5" gap between the platform and car doors allowing approximately 2" of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5” by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor’s window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor’s window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **<u>bold/underline</u>**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	PSD System 1	PSD System 2	PSD System 3
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are “existing” as defined by code. All the rolling stock is also to be considered “existing” under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60” radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36” of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

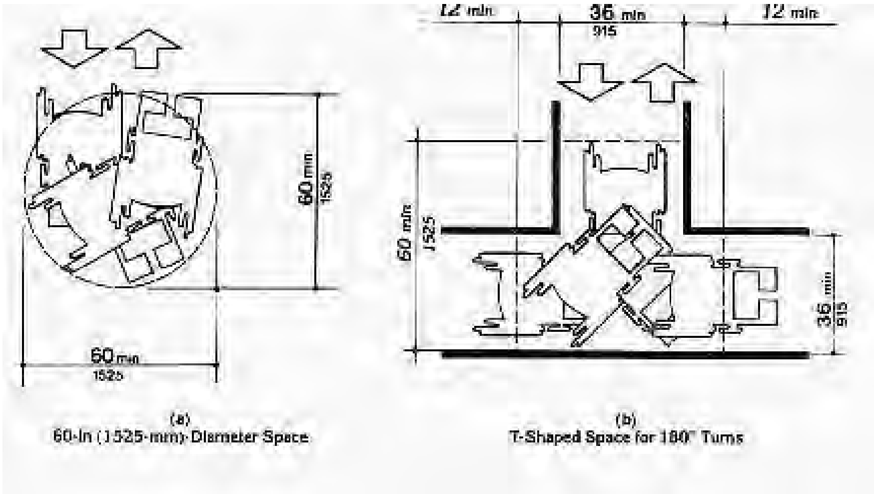
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

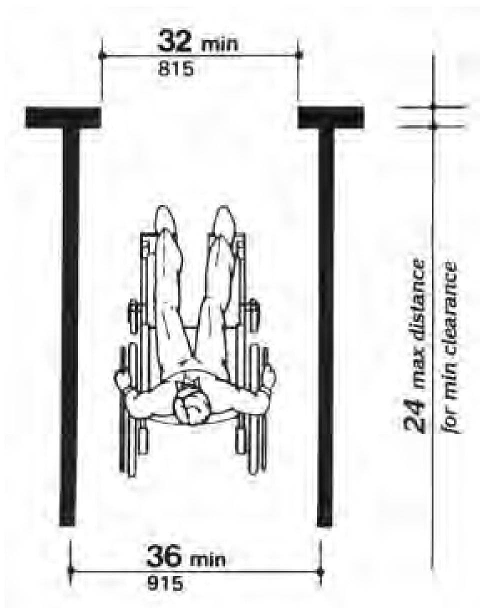


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For <u>all</u> the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

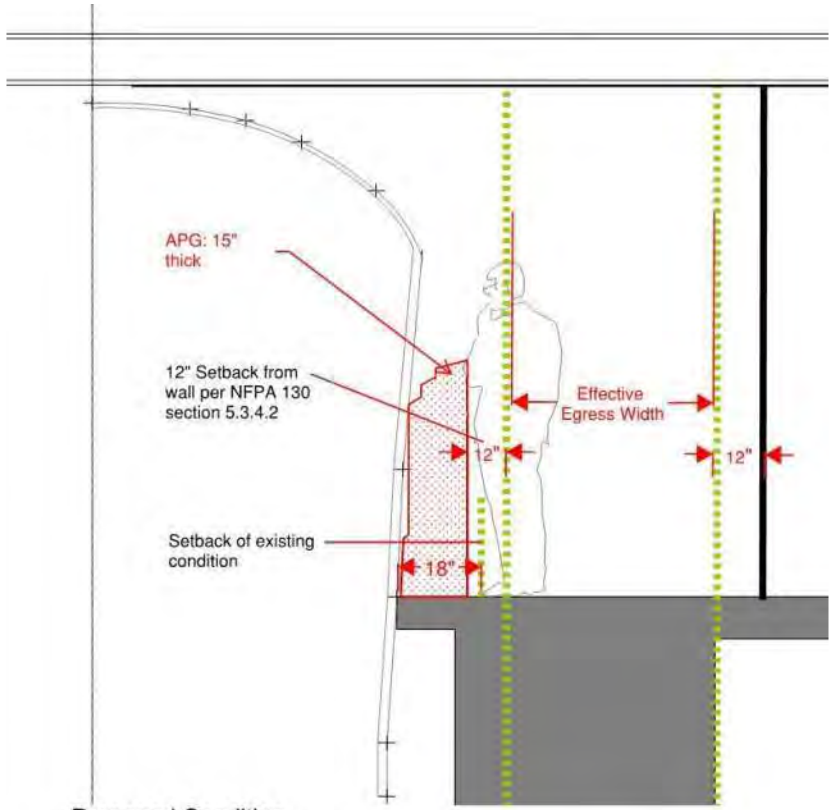
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15" of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

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Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

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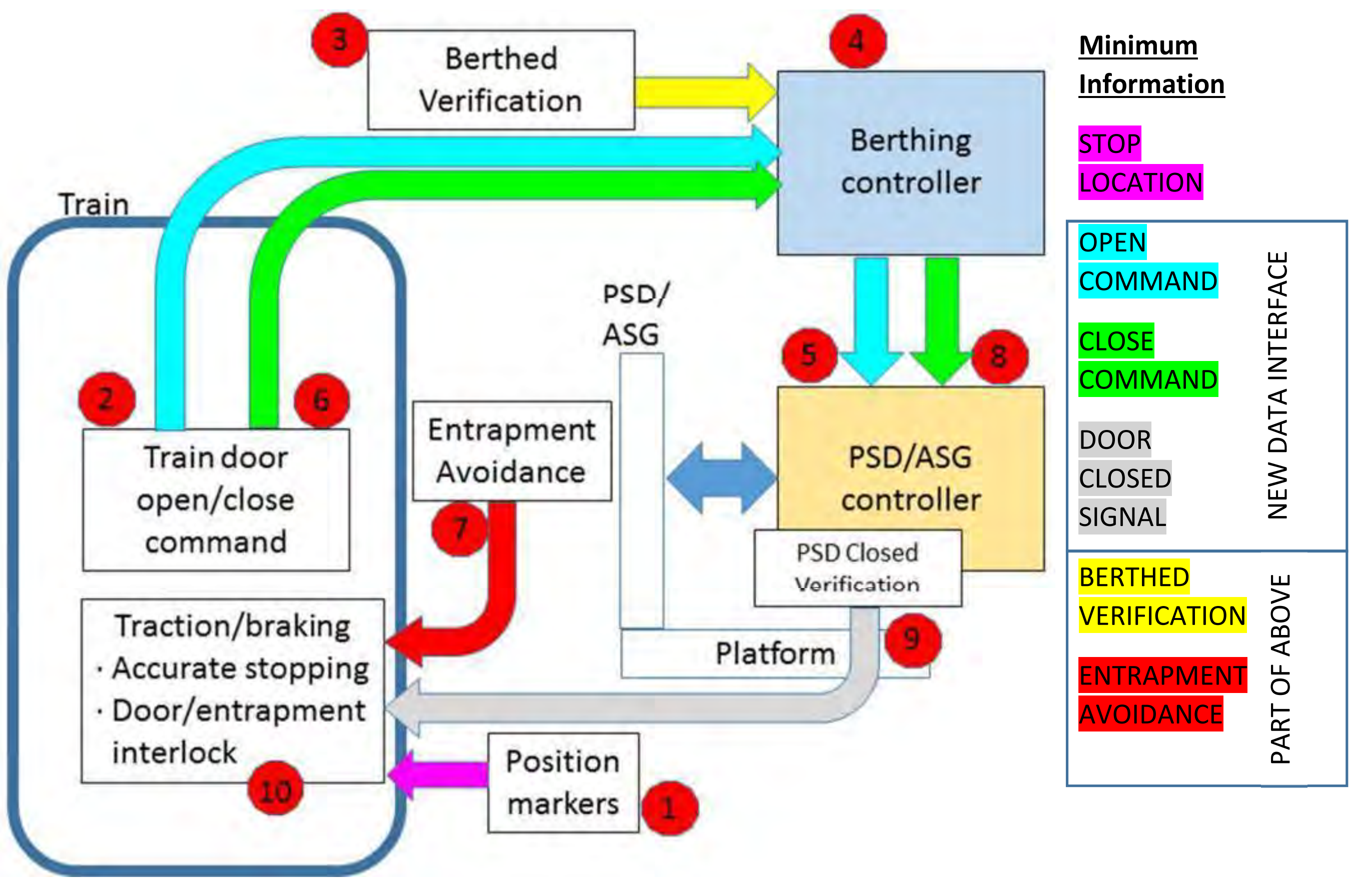
DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.
B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.
C. Dwell during passenger boarding/alighting
D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.
E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



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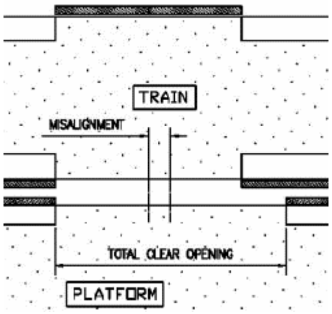
Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5" clear opening, a design for NY should meet the ADA Accessibility Guideline of 36".

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a 'distance totem' which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy's COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

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Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically

If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.

For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4'-0"). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

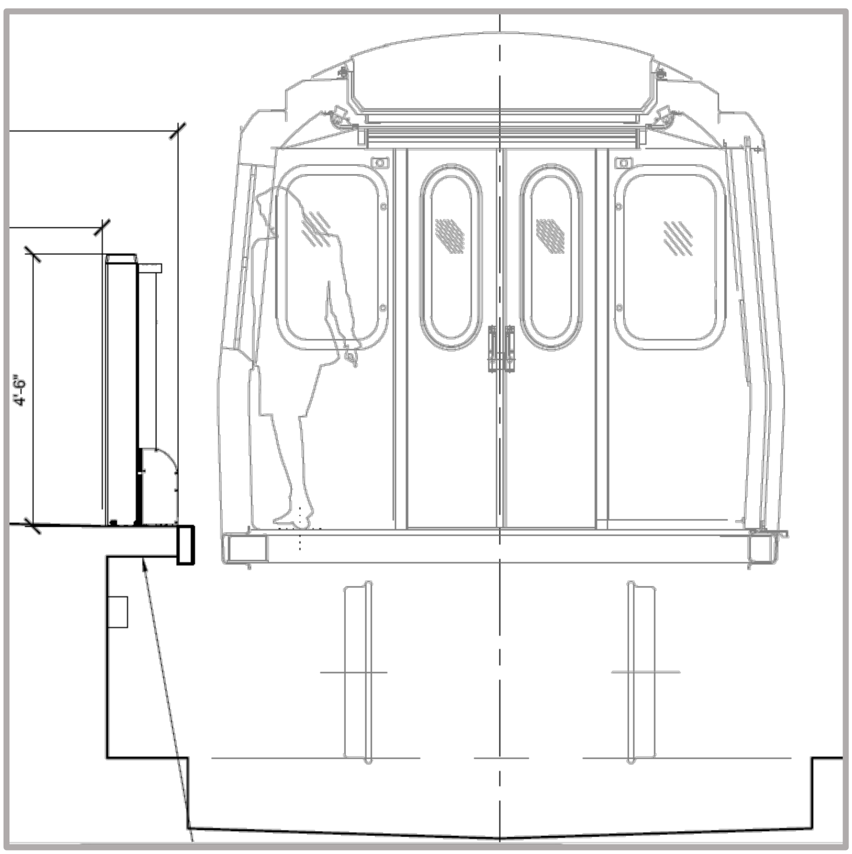

Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

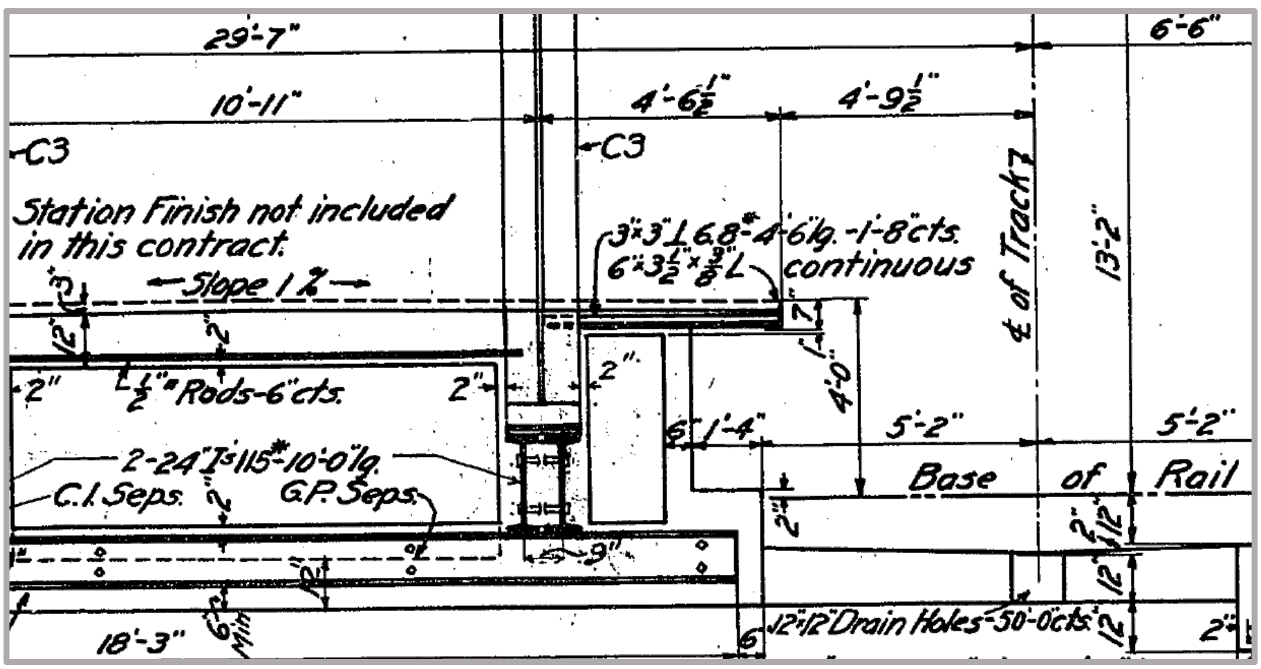

Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

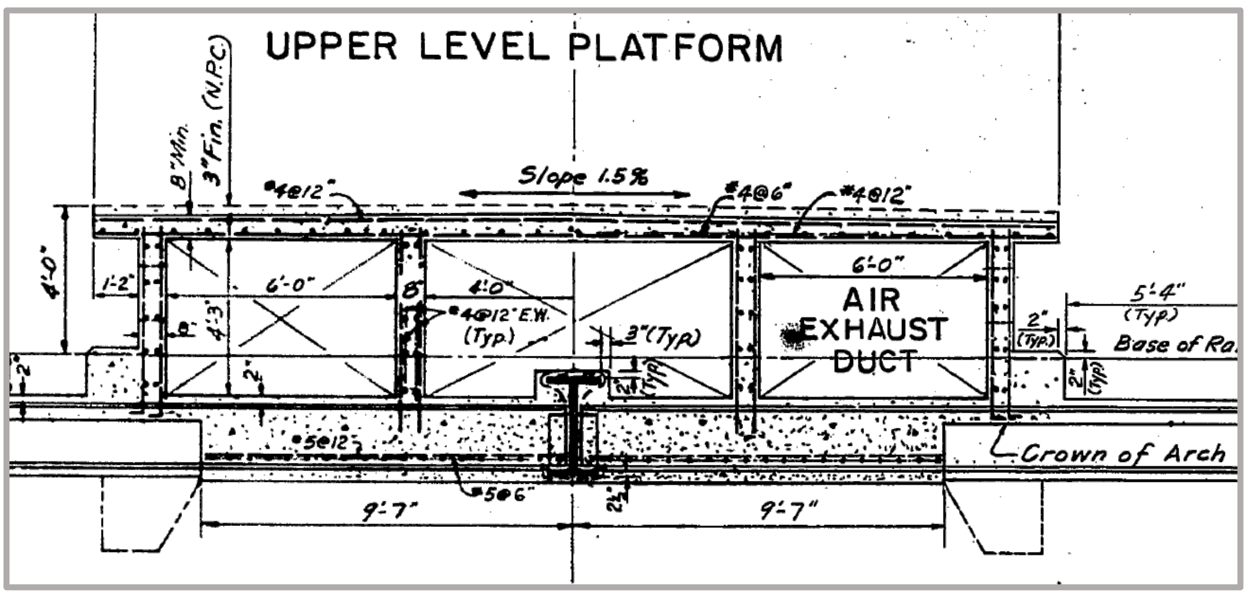

Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

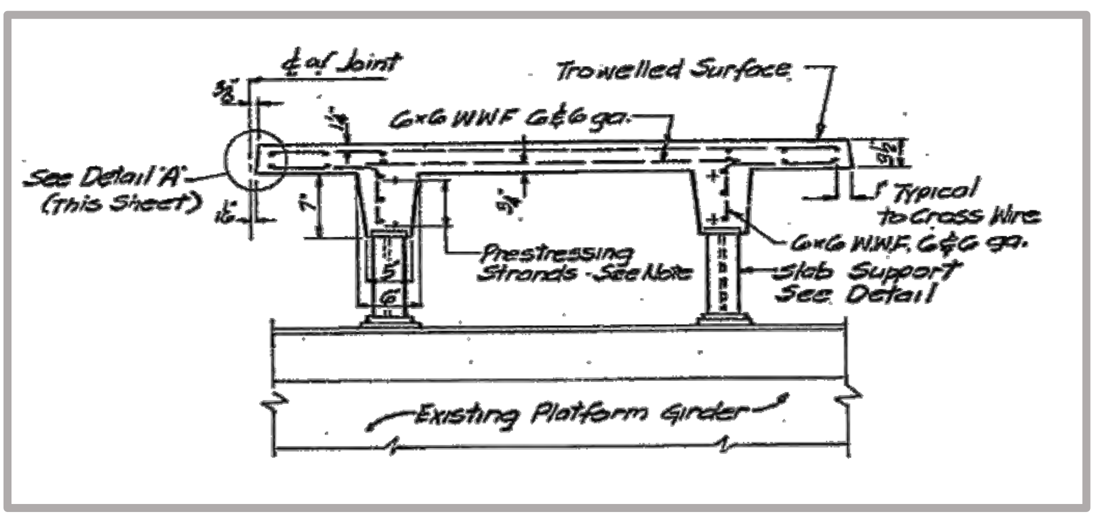

Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

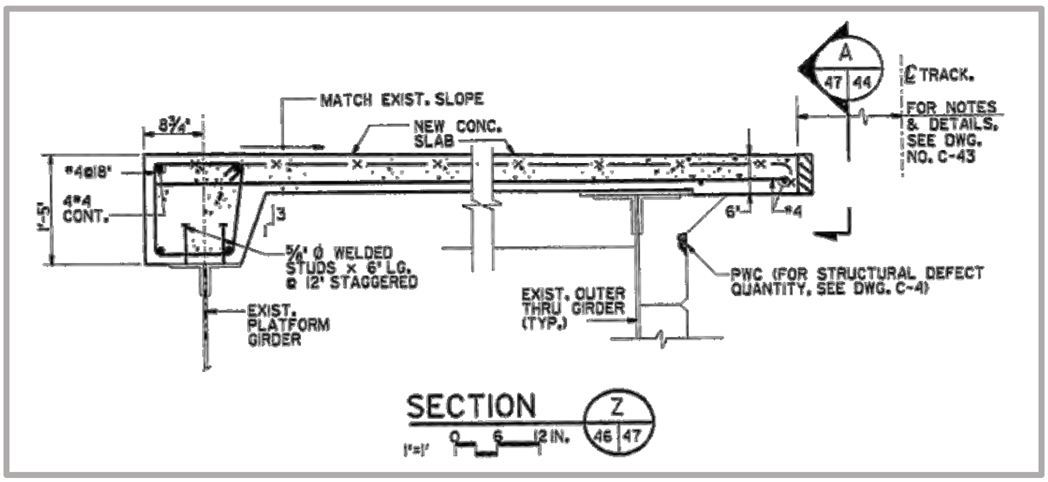

Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2'-9"), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

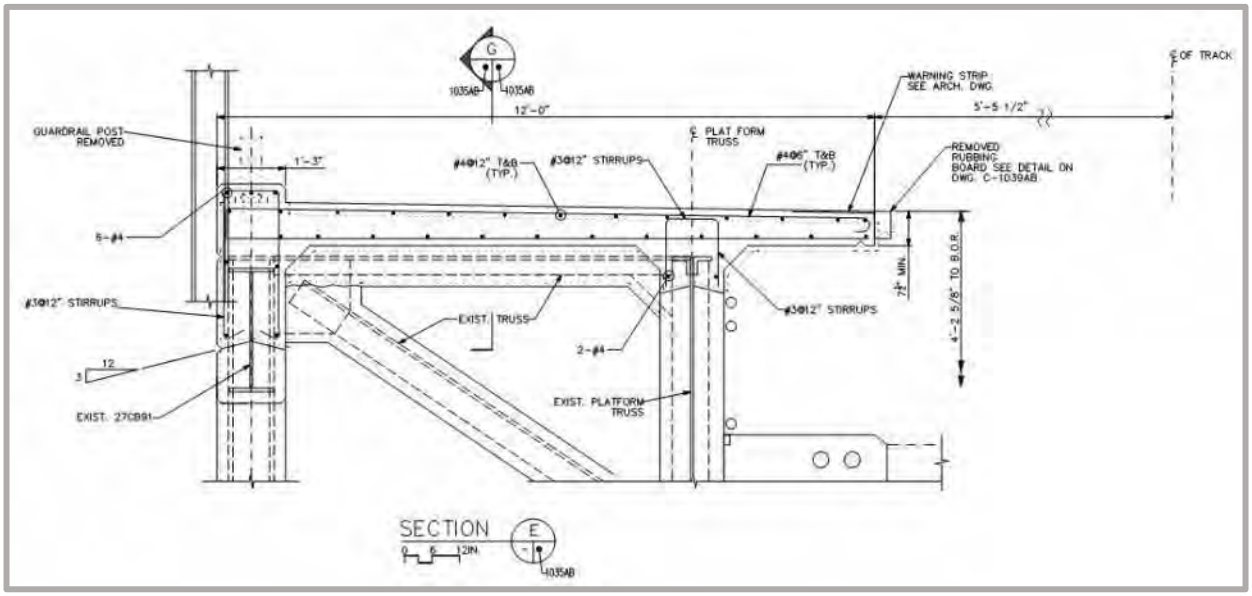

Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3” thick structural slab with an approximately 3” thick topping slab. If the topping slab is fully removed, a 6” thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6” thick slab will be sufficient for a cantilever length of up to approximately 3’-0”, greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6” structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6” minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

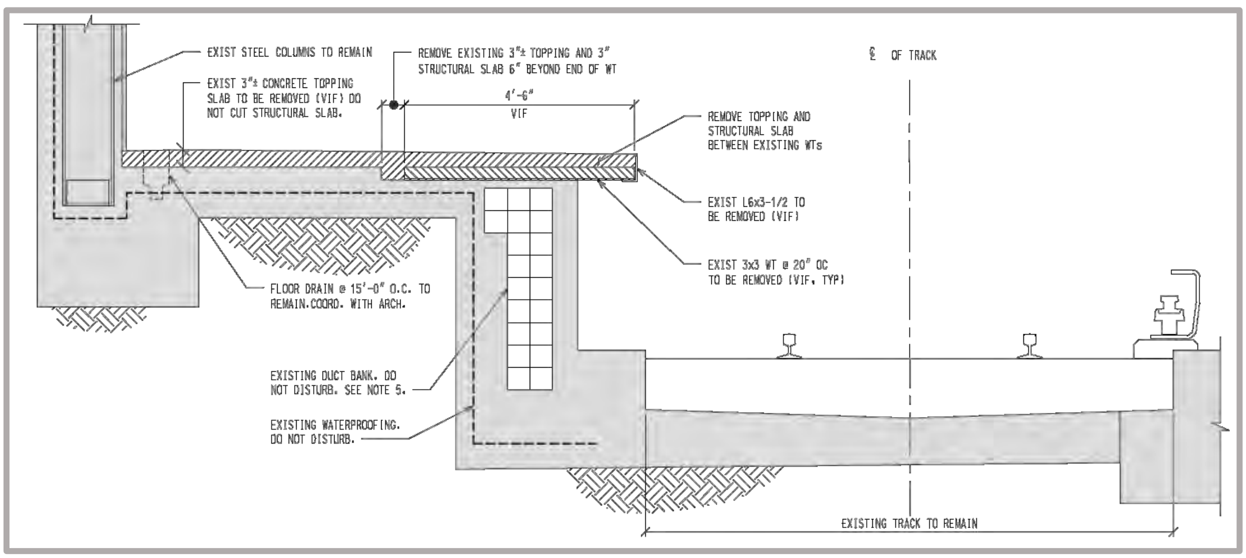

Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

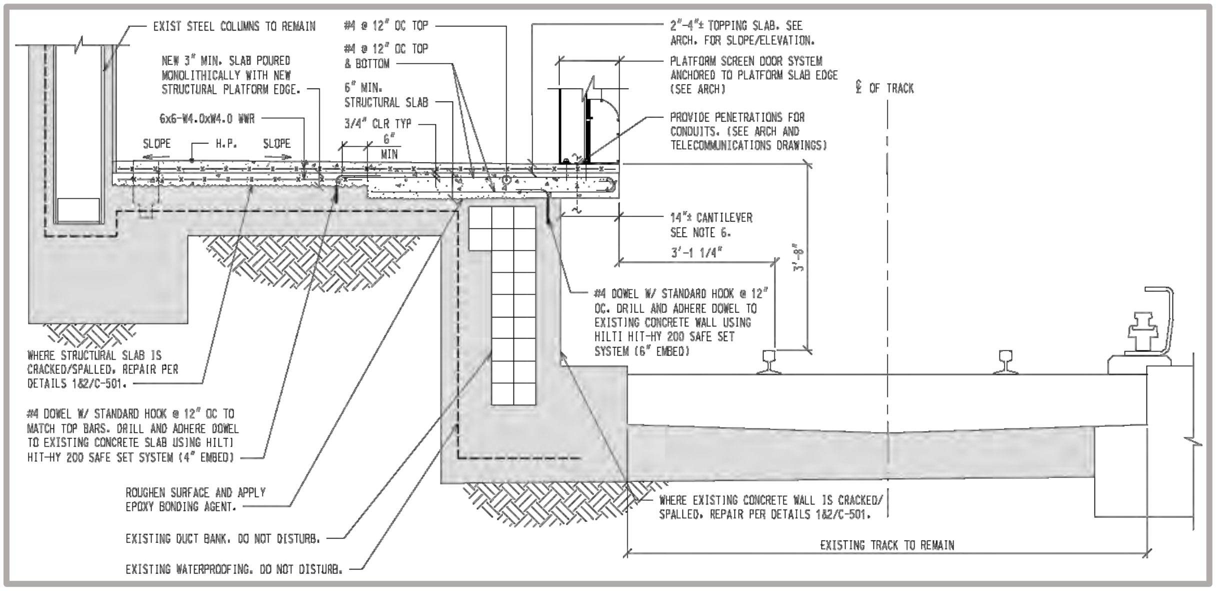

Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

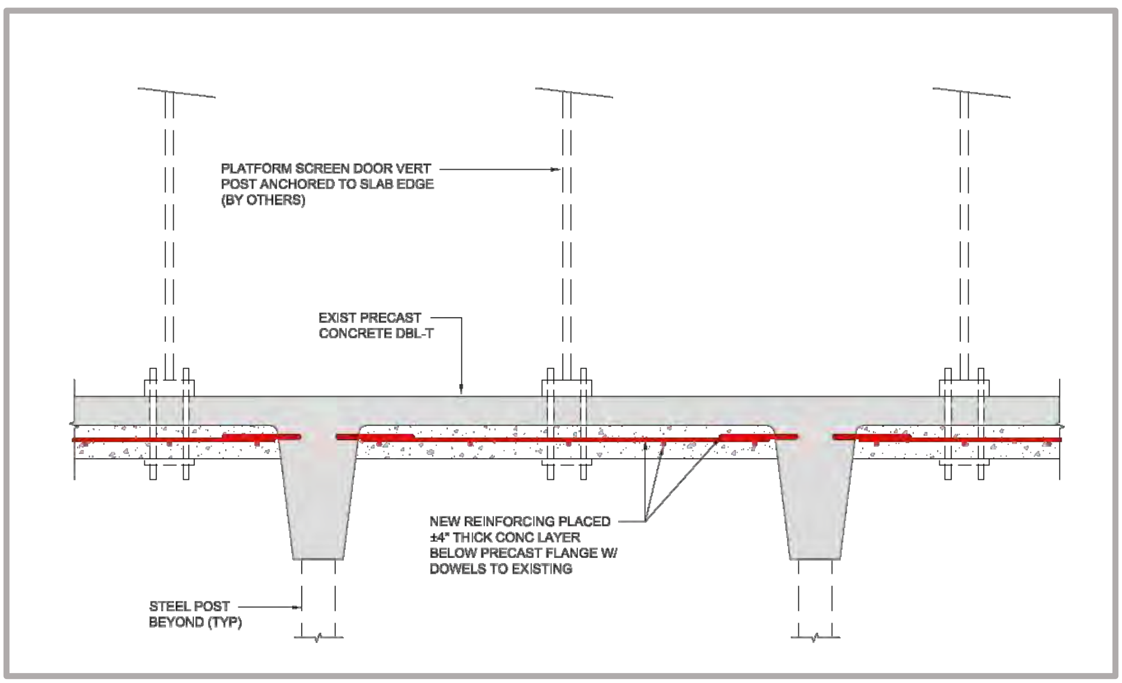

Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5' – 11" of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis

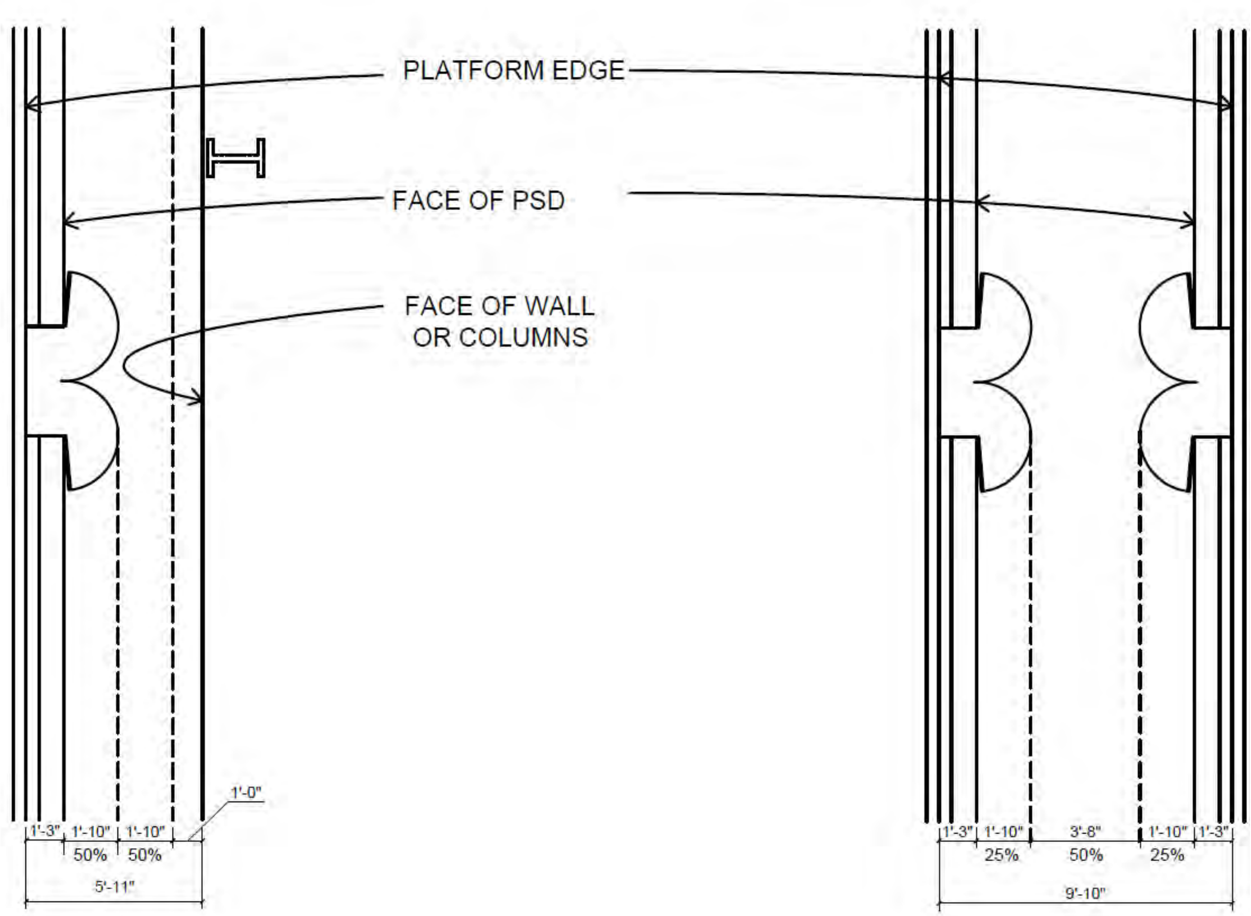

FIGURE 1: SIDE PLATFORM

FIGURE 2: CENTER PLATFORM

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

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MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the	9	$ 63,500 per month [Year 01]	$ 571,500		
	platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance	12	$ 83,590 per month [Year 02]	$ 1,003,080		
	since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
	remedial repair performed as needed, 24/7, for the	12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
	platform screen door system and ancillary equipment.					
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663		

ITEM NO.	DESCRIPTION		RATE	
7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *	
		Year 3	$ 257 per hour *	
	Optional :	Year 4	$ 268 per hour *	
	Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

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VJ
ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations
ESTIMATE DATE:	June 12, 2019

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VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

MTA/NYCT

June 12, 2019

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.2 *APGs / PSDs will provide 39 emergency egress doors with push bars per platform*
1.3 *Each platform edge will have 50 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10” x 10” H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 It is assumed that each train has 10 cars on this line
2.2 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.3 In respect of the PSD option, only platforms that have not been upgraded in the recent past will require platform edge replacement.
2.4 There are no special security requirements made necessary by installation of the APG system
2.5 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.6 This estimate does not provide for the replacement of Platform Edge Lighting
2.7 Premium cost for night time work is considered 50% of total labor cost

3.0 ***Exclusions - Costs not included in the estimate:***

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

MTA/NYCT

June 12, 2019

BASIS OF ESTIMATE

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems
3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length
3.4 Costs associated with NYCT State Of Good Repair improvements to the station
3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.
3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs
3.7 Escalation Cost is not included; Anticipate at 5% per annum.
3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.
3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium
3.10 NYCT project cost is not included
3.11 GO and flagging cost is not included
3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or "soft" costs:***

4.1 Design and Construction Contingency
4.2 Contractor O & P
4.3 Insurance
4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 Given the limited time available, no drawings were developed to support this estimate.

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MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

June 12, 2019

	ORDER OF MAGNITUDE COSTS		MRN 008	MRN 010	MRN 027
	DESCRIPTION		5TH AVE./59TH ST.	49TH STREET	ATLANTIC AVE. BARCLAYS CTR.
1	AUTOMATIC PLATFORM GATES (APG'S)		$16,516,828	$17,737,576	$16,629,898
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$16,516,828	$17,737,576	$16,629,898
4	GENERAL REQUIREMENTS	15.00%	$2,477,524	$2,660,636	$2,494,485
	SUB-TOTAL:		$18,994,352	$20,398,212	$19,124,382
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$4,748,588	$5,099,553	$4,781,096
	SUB-TOTAL:		$23,742,940	$25,497,765	$23,905,478
6	OVERHEAD & PROFIT	15.00%	$3,561,441	$3,824,665	$3,585,822
	SUB-TOTAL:		$27,304,381	$29,322,430	$27,491,300
7	BONDS & INSURANCE	3.75%	$1,023,914	$1,099,591	$1,030,924
	SUB-TOTAL:		$28,328,295	$30,422,021	$28,522,223
	SUB-TOTAL:		$28,328,295	$30,422,021	$28,522,223
	SUBTOTAL CONSTRUCTION COST W/O ACM		$28,328,295	$30,422,021	$28,522,223
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		$28,328,295	$30,422,021	$28,522,223
10	DESIGN CONSULTANT FEES	10.00%	$2,832,829	$3,042,202	$2,852,222
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		$31,161,124	$33,464,223	$31,374,446
	ADD ALTERNATIVES				
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		$4,697,318	$5,331,194	4,531,048
	Add for Markups (as above)	88.66%	4,164,778	4,726,791	4,017,358
	SUB-TOTAL PSD ALTERNATIVE		$8,862,097	$10,057,985	$8,548,406
	TOTAL PROJECT COST (PSD OPTION)		$40,023,221	$43,522,208	$39,922,852

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

12-Jun-19

STATION : 5TH AVE./59TH ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	615	LF		
5	LENGTH OF THE PLATFORM EDGE [ASTORIA BOUND] =	615	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,230**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,230	LF	7	8,610
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,150	SF	12	73,800
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,232	EA	25	30,800
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,232	EA	25	30,800
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,230	LF	95	116,850
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,230	LF	15	18,450
26	Remove existing platform tiles	1,230	LF	12	14,760
27	Sawcut existing topping concrete at perimeter of removal area	1,230	LF	5	6,150
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,380	SF	8	59,040
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,230	SF	15	18,450

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

12-Jun-19

STATION : 5TH AVE./59TH ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room A [7'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,780
39	CMU Wall for equipment room	420	SF	45	18,900
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	203	SF	30	6,075
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	420	SF	40	16,800
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	5,040
46	Concrete cove to match existing	42	LF	20	840
47	Interior Wall Finish - Paint	420	SF	5	2,100
48	Allow for Misc. floor & ceiling finishes	203	SF	15	3,038
49	Allow for 4" thick concrete pads for equipment	51	SF	20	1,013
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
61	Spare Parts - Approx. 10% of Material Cost	1	LS	227,910	227,910
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

12-Jun-19

STATION : 5TH AVE./59TH ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,230	LF	60	73,800
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	700	LF	60	42,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	750	LF	60	45,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

12-Jun-19

STATION : 5TH AVE./59TH ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,811,576	3,811,576
112					
113	**TOTAL PSD WORK:**				**$ 16,516,828**
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,974	SF	750	3,730,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	421,942	421,942
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,657
129	L6x6x1/2 continuous angle	9	TONS	17,500	158,424
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	120	HRS	162	19,440
137	Remove signal cables	900	LF	40	36,000
138	Remove conduit; Assuming 1"	900	LF	55	49,500
139	Install conduit in new position	900	LF	110	99,000
140	Install replacement cable; assumed single cable #12	900	LF	125	112,500
141	Re-commission / testing as required	3	EA	12,500	37,500
142	Engineering / Shop Drawings / Etc.	3	EA	7,500	22,500
143	Premium Time	2,353	HRS	49	114,356

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

12-Jun-19

STATION : 5TH AVE./59TH ST.

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,250)	SF	750	(1,687,500)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	227,910	(227,910)
152	Platform Edge Reconstruction work	(1)	LS	560,600	(560,600)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,230)	LF	30	(36,900)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,083,997	1,083,997
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 4,697,318

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

12-Jun-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	703	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	703	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,406**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,406	LF	7	9,842
14	Remove 5' wide section of 3" deep structural slab to platform edge	7,030	SF	12	84,360
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	142	CY	2,500	355,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,408	EA	25	35,200
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,408	EA	25	35,200
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,406	LF	95	133,570
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,406	LF	15	21,090
26	Remove existing platform tiles	1,406	LF	12	16,872
27	Sawcut existing topping concrete at perimeter of removal area	1,406	LF	5	7,030
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,436	SF	8	67,488
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10' wide strip	320	SF	8	2,560
30	New Work				
31	New concrete topping to match existing	1,406	SF	15	21,090

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

12-Jun-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	320	SF	15	4,800
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room#1 [7'-6" x 17'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	32	LF	90	2,880
39	CMU Wall for equipment room	320	SF	45	14,400
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	128	SF	30	3,825
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	320	SF	40	12,800
45	Mosaic Band to match existing - Assuming 8" high	32	LF	120	3,840
46	Concrete cove to match existing	32	LF	20	640
47	Interior Wall Finish - Paint	320	SF	5	1,600
48	Allow for Misc. floor & ceiling finishes	128	SF	15	1,913
49	Allow for 4" thick concrete pads for equipment	32	SF	20	638
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Equipment Room#2 [7'-6" x 17'-0"]**				
56	Build off existing platform slab		Note		
57	Form 8" wide concrete curb including dowelling to platform slab	32	LF	90	2,880
58	CMU Wall for equipment room	320	SF	45	14,400
59	Vertical connections with existing structure	20	LF	25	500
60	Roof for equipment room	128	SF	30	3,825
61	Fire rated door including frame & hardware	1	EA	2,500	2,500
62	Exterior wall finish				
63	Ceramic Tiling to match existing	320	SF	40	12,800
64	Mosaic Band to match existing - Assuming 8" high	32	LF	120	3,840
65	Concrete cove to match existing	32	LF	20	640
66	Interior Wall Finish - Paint	320	SF	5	1,600
67	Allow for Misc. floor & ceiling finishes	128	SF	15	1,913
68	Allow for 4" thick concrete pads for equipment	32	SF	20	638
69	Allowance for Mechanical Scope	1	LS	40,000	40,000
70	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
71	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
72	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

12-Jun-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
73					
74	**Automatic Platform Gates [APGs] - 4'-6" High**				
75	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
76	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
77	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
78	Platform End Gates (PEGs)	4	EA	13,000	52,000
79	Fixed Panels including framing and support; 4'-6" High	3,042	SF	750	2,281,500
80	Spare Parts - Approx. 10% of Material Cost	1	LS	263,550	263,550
81	Testing and commissioning	800	HRS	160	127,944
82	Product Warranty	1	LS	1,000,000	1,000,000
83	Allowance for Braille Signage	80	EA	2,500	200,000
84					
85	**Electrical**				
86	Electrical Upgrades				
87	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
88	Power and Lighting				
89	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
90	Allow for conduit / cable runs for power and communications under platform edge	1,406	LF	60	84,360
91	PSD Connections	1	LS	75,000	75,000
92	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
93	Power to PSD Rooms from EDR [Conduit & Cable]	350	LF	60	21,000
94	Reserve power to PSD Room from EDR [Conduit & Cable]	400	LF	60	24,000
95	No allowance for new lighting as if APG's are used		Note		EXCL.
96	Grounding				
97	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
98	MISC				
99	Testing and commissioning	1	EA	30,000	30,000
100	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
101					
102	**Communications**				
103	FA System				
104	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
105	CCTV coverage				
106	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
107	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
108	Berthing Technology Sensors				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

12-Jun-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
109	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
110	Train Door Detection System				
111	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
112	Entrapment concerns				
113	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
114	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
115	Engineering and Testing	1,000	Hrs	160	159,930
116	Centralized monitoring/control				
117	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
118	MISC				
119	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
120	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
121	Site Survey and Inspections	1	LS	100,000	100,000
122	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
123	Furnish Test Equipment allowance	1	LS	500,000	500,000
124	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
125					
126	Training				
127	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
128					
129	Out of hours Work				
130	Allow loss of production to work at night say 50%	1	LS	4,093,287	4,093,287
131					
132	TOTAL PSD WORK:				$ 17,737,576
134					
135	ADD ALTERNATIVE				
136					
137	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
138					
139	ADD				
140	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
141	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
142	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

12-Jun-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
143	Platform End Gates (PEGs)	4	EA	18,000	72,000
144	Fixed Panels including framing and support; Assuming 8'-0" high	6,382	SF	750	4,786,365
145	Spare Parts - Approx. 10% of Material Cost	1	LS	485,302	485,302
146	Structual framing / bracing				
147	HSS4x4x1/2 hanger	5	TONS	17,500	93,155
148	L6x6x1/2 continuous angle	10	TONS	17,500	181,093
149	Drilling and bolting - 4 bolts at each connection	562	EA	216	121,478
150	Platform Edge Repair				
151	Remove concrete platform edge				Previously done
152	Platform edge repair				Previously done
153	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
154	Signal Work [Each 300' length is associated with one signal light]				
155	Disconnects	120	HRS	162	19,440
156	Remove signal cables	900	LF	40	36,000
157	Remove conduit; Assuming 1"	900	LF	55	49,500
158	Install conduit in new position	900	LF	110	99,000
159	Install replacement cable; assumed single cable #12	900	LF	125	112,500
160	Re-commission / testing as required	3	EA	12,500	37,500
161	Engineering / Shop Drawings / Etc.	3	EA	7,500	22,500
162	Premium Time	2,353	HRS	49	114,356
163					
164	OMIT				
165	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
166	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
167	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
168	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
169	Fixed Panels including framing and support; 4'-6" High	(3,042)	SF	750	(2,281,500)
170	Spare Parts - Approx. 10% of Material Cost	(1)	LS	263,550	(263,550)
171	Platform Edge Reconstruction work	(1)	LS	624,960	(624,960)
172	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
173	Conduit running under Platform Edge	(1,406)	LF	30	(42,180)
175	Allow loss of production to work at night say 50%	1	LS	1,230,276	1,230,276
176					
177	PREMIUM ASSOCIATED WITH PSD's				$ 5,331,194

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

12-Jun-19

STATION : ATLANTIC AVE. BARCLAYS CTR.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	618	LF		
5	LENGTH OF THE PLATFORM EDGE =	618	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,236**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,236	LF	7	8,652
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,180	SF	12	74,160
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,238	EA	25	30,950
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,238	EA	25	30,950
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,236	LF	95	117,420
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,236	LF	15	18,540
26	Remove existing platform tiles	1,236	LF	12	14,832
27	Sawcut existing topping concrete at perimeter of removal area	1,236	LF	5	6,180
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,416	SF	8	59,328
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-0" wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,236	SF	15	18,540

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

12-Jun-19

STATION : ATLANTIC AVE. BARCLAYS CTR.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Platform column restructuring**				
37	Demolition				
38	Install, maintain and remove temporary support	2	LS	15,000	30,000
39	Breakout existing platform slab for new column	2	LS	5,000	10,000
40	New Work				
41	Excavate for foundation for new column	2	EA	1,500	3,000
42	Foundation for new column	2	EA	5,000	10,000
43	New structural steel column	2	EA	20,000	40,000
44	Extend and repair beams above	2	LS	5,000	10,000
45	Grillage	2	EA	10,000	20,000
46					
47	**Equipment Room [7'-0" x 27'-6"]**				
48	Build off existing mezzanine slab		Note		
49	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
50	CMU Wall for equipment room	415	SF	45	18,675
51	Vertical connections with existing structure	20	LF	25	500
52	Roof for equipment room	193	SF	30	5,775
53	Fire rated door including frame & hardware	1	EA	2,500	2,500
54	Exterior wall finish				
55	Ceramic Tiling to match existing	415	SF	40	16,600
56	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
57	Concrete cove to match existing	42	LF	20	830
58	Interior Wall Finish - Paint	690	SF	5	3,450
59	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
60	Allow for 4" thick concrete pads for equipment	48	SF	20	963
61	Allowance for Mechanical Scope	1	LS	40,000	40,000
62	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
63	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
64	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
65					
66	**Automatic Platform Gates [APGs] - 4'-6" High**				
67	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
68	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
69	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
70	Platform End Gates (PEGs)	4	EA	13,000	52,000
71	Fixed Panels including framing and support; 4'-6" High	2,277	SF	750	1,707,750
72	Spare Parts - Approx. 10% of Material Cost	1	LS	229,125	229,125

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

12-Jun-19

STATION : ATLANTIC AVE. BARCLAYS CTR.

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
73	Testing and commissioning	800	HRS	160	127,944
74	Product Warranty	1	LS	1,000,000	1,000,000
75	Allowance for Braille Signage	80	EA	2,500	200,000
76					
77	**Electrical**				
78	Electrical Upgrades				
79	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
80	Power and Lighting				
81	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
82	Allow for conduit / cable runs for power and communications under platform edge	1,236	LF	60	74,160
83	PSD Connections	1	LS	75,000	75,000
84	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
85	Power to PSD Room from EDR [Conduit & Cable]	200	LF	60	12,000
86	Reserve power to PSD Room from EDR [Conduit & Cable]	250	LF	60	15,000
87	No allowance for new lighting as if APG's are used		Note		EXCL.
88	Grounding				
89	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
90	MISC				
91	Testing and commissioning	1	EA	30,000	30,000
92	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
93					
94	**Communications**				
95	FA System				
96	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
97	CCTV coverage				
98	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
99	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
100	Berthing Technology Sensors				
101	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
102	Train Door Detection System				
103	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
104	Entrapment concerns				
105	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
106	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
107	Engineering and Testing	1,000	Hrs	160	159,930
108	Centralized monitoring/control				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

12-Jun-19

STATION : ATLANTIC AVE. BARCLAYS CTR.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
109	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
110	MISC				
111	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
112	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
113	Site Survey and Inspections	1	LS	100,000	100,000
114	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
115	Furnish Test Equipment allowance	1	LS	500,000	500,000
116	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
117					
118	Training				
119	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
120					
121	Out of hours Work				
122	Allow loss of production to work at night say 50%	1	LS	3,837,669	3,837,669
123					
124	TOTAL PSD WORK:				$ 16,629,898
126					
127	ADD ALTERNATIVE				
128					
129	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
130					
131	ADD				
132	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
133	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
134	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
135	Platform End Gates (PEGs)	4	EA	18,000	72,000
136	Fixed Panels including framing and support; Assuming 8'-0" high	5,022	SF	750	3,766,365
137	Spare Parts - Approx. 10% of Material Cost	1	LS	424,102	424,102
138	Structual framing / bracing				
139	HSS4x4x1/2 hanger	5	TONS	17,500	82,049
140	L6x6x1/2 continuous angle	9	TONS	17,500	159,197
141	Drilling and bolting - 4 bolts at each connection	494	EA	216	106,790
142	Platform Edge Repair				
143	Remove concrete platform edge				Previously done
144	Platform edge repair				Previously done
145	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for R - Line Stations

12-Jun-19

STATION : ATLANTIC AVE. BARCLAYS CTR.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
146	Signal Work [Each 300' length is associated with one signal light]				
147	Disconnects	80	HRS	162	12,960
148	Remove signal cables	600	LF	40	24,000
149	Remove conduit; Assuming 1"	600	LF	55	33,000
150	Install conduit in new position	600	LF	110	66,000
151	Install replacement cable; assumed single cable #12	600	LF	125	75,000
152	Re-commission / testing as required	2	EA	12,500	25,000
153	Engineering / Shop Drawings / Etc.	2	EA	7,500	15,000
154	Premium Time	1,569	HRS	49	76,253
155					
156	OMIT				
157	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
158	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
159	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
160	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
161	Fixed Panels including framing and support; 4'-6" High	(2,277)	SF	750	(1,707,750)
162	Spare Parts - Approx. 10% of Material Cost	(1)	LS	229,125	(229,125)
163	Platform Edge Reconstruction work	(1)	LS	561,260	(561,260)
164	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
165	Conduit running under Platform Edge	(1,236)	LF	30	(37,080)
166					
167	Allow loss of production to work at night say 50%	1	LS	1,045,626	1,045,626
168					
169	PREMIUM ASSOCIATED WITH PSD's				$ 4,531,048

New York City Transit

REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR 'W' LINE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

FINAL SUBMITTAL DATE: January 11, 2019

STV 100 Years

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Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. Our Tier 1 analysis found no instances of door misalignment between car classes for this line. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 23 newly evaluated stations, 20 have been found to be not suitable for the installation of PSDs.

[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to low-height barriers]

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues; the platform edge barriers are 15" wide or greater. Where an existing object (wall, stair, and railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Stations are found to be infeasible where these PSDs:
  - Limit the ability of a wheelchair to turn within a 5'-0" circle
  - Limit path of travel to less than a 32" pinch width (defined as an obstruction that measures less than 2'-0" longitudinally, i.e. columns)
  - Limit path of travel to be less than a 36" corridor as defined by the edge of a staircase, railing or room
- Insufficient space for the PSD equipment room; the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow; due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements in regard to the placement of these new barriers in an existing station environment.
- Structural considerations; existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the previously proposed 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the PSD barriers and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is used for refuse removal at the W line stations. For a PSD installation, it is proposed that keys be given to crew members so that they can manually open the typical PSD doors or emergency egress doors for the (off) loading of garbage carts. Per existing procedures, the distance between the driver's cabin and the first available slot for loading a garbage cart is constantly changing as the train proceeds through multiple stops. It will therefore not be possible to establish a unique stop marker for the garbage train; each instance of garbage pick-up will need the driver to stop at a different location, guided by personnel on the platform. This additional step in berthing the garbage train will likely negatively affect productivity for this activity. In addition, the currently-used metal garbage carts could potentially damage the PSD system during loading. This is evidenced in damage from these carts along walls adjacent to station refuse rooms. In conclusion, the implementation of a PSD system will likely require a re-design of the refuse removal process

The table on the following page summarizes these findings, and shows that platform edge barriers are feasible at 13% of the 'W' Line stations. Total implementation cost would be $97.7M for APGs and $83.5M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; that estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of $931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 3 feasible stations, the aggregate annual maintenance cost would be $2.8M.

Summary Table

W Line Summary of Feasibility					(13% feasible; 3/23)		
MR No.	**Station Name**	**Station Type**	**Platform Type**	**Feasible Yes / No**	**Issues / Reason for Failure**	**Cost APGs**	**Cost PSDs**
001	Astoria - Ditmars Blvd.	ELV	Center/Island	No	Precast	-	-
002	Astoria Blvd	ELV	Center/Island	No	Precast	-	-
003	30th Ave. Grand Ave	ELV	Side	No	Precast	-	-
004	Broadway	ELV	Side	No	Precast	-	-
005	36th Avenue Washington Avenue	ELV	Side	No	Precast	-	-
006	39th Avenue Beebe Ave	ELV	Side	No	Precast	-	-
007	Lexington Ave. 59th St.	SUB	Center/Island	No	ADA Clearance	-	-
008	5th Ave. / 59th St.	SUB	Side	Yes	-	$ 31.2M	$ 40.0M
009	57th Street 7th Ave	SUB	Center/Island	No	ADA Clearance	-	-
010	49th Street	SUB	Side	Yes	-	$ 33.5M	$ 43.5M
011	Times Square 42nd Street	SUB	Center/Island	No	ADA Clearance	-	-
012	34th Street Herald Sq.	SUB	Center/Island	No	ADA Clearance	-	-
013	28th Street	SUB	Side	No	No PSD Room Location	-	-
014	23rd Street	SUB	Side	No	ADA Clearance	-	-
015	14th St. Union Square	SUB	Center/Island	No	ADA Clearance	-	-
016	8th St. NYU	SUB	Side	No	ADA Clearance	-	-
017	Prince Street	SUB	Side	No	ADA Clearance	-	-
018	Canal Street (UL)	SUB	Side	No	ADA Clearance	-	-
020	City Hall	SUB	Center/Island	No	ADA Clearance		
021	Cortland Street	SUB	Side	No	ADA Clearance	-	-
022	Rector Street	SUB	Side	No	ADA Clearance		
023	Whitehall St. South Ferry	SUB	Center/Island	No	ADA Clearance	-	-
461	Queensboro Plaza	ELV	Center/Island	Yes	-	$ 33.1M	-
					TOTAL	**$ 97.7M**	**$ 83.5M**

1.0 Station Assessments

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1.01 – MR 001 | Astoria Ditmars Boulevard Station

Summary: *Astoria Ditmars Boulevard Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 1).*

Description

Astoria Ditmars Boulevard Station is an elevated station consisting of a center / island platform. The platform structure is precast concrete. The width of the platform is 15'-0" throughout. There are two staircases at the center of the platform. The platform is straight with two rows of a columns supporting the station canopy. Column faces measure 3'-0" from the platform edge throughout. The canopy covers the center third of the platform. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Astoria Ditmars Boulevard Station

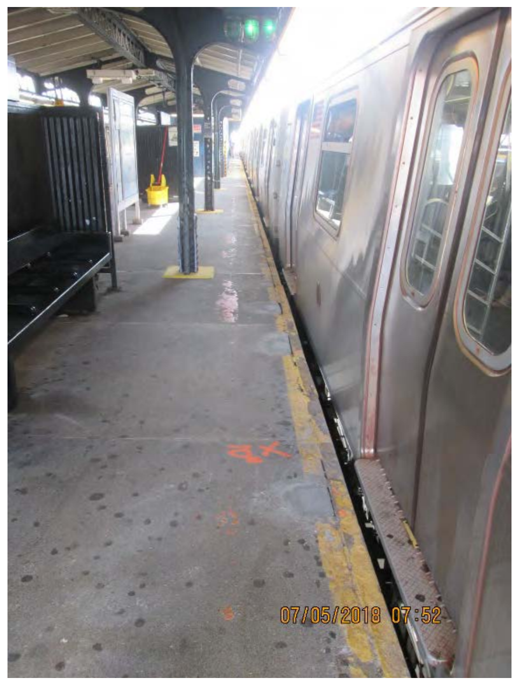

Figure 2 *– Precast Slab Seams*
Astoria Ditmars Boulevard Station

1.02 – MR 002 | Astoria Boulevard Station

Summary: *Astoria Boulevard Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 1).*

Description

Astoria Boulevard Station is an elevated station with two center / island platforms. The platform structures are precast concrete. The width of the platforms is 17'-8" throughout. There are two staircases at the center of the platforms. The platforms are straight with two rows of a columns supporting their respective station canopies. Column faces measure 3'-4" from their adjacent platform edges throughout. The canopies cover approximately half of the platforms. See figure 1 & 2 for reference.

Figure 1 *– General Station Condition*
Astoria Boulevard Station

Figure 2 *– Precast Slab*
Astoria Boulevard Station

1.03 – MR 003 | 30th Avenue Station

__Summary:__ 30th Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 1).

Description

30th Avenue Station is an elevated station with two straight side platforms. The platform structures are precast concrete. The width of the platforms is approximately 11'-0", narrowing to 8'-2" at the south ends. There are two staircases at the center of each platform. The platforms are straight with a single row of columns supporting their respective station canopies. Column faces measure 3'-0" from their adjacent platform edges throughout. The canopies cover approximately half of the platforms. See figure 1 & 2 for reference.

Figure 1 *– Overall view*
30th Avenue Station

Figure 2 *– Precast concrete platforms*
30th Avenue Station

1.04 – MR 004 | Broadway Station

Summary: *Broadway Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 1).*

Description

Broadway Station is an elevated station with two straight side platforms. The platform structures are precast concrete. There are two staircases at the center of each platform. The platforms are straight with a single row of columns supporting their respective station canopies the canopies cover approximately half of the platforms.

NOTE: Station specific dimensions and photographs could not be obtained at the time of this report due to station closure for rehabilitation.

1.05 – MR 005 | 36th Avenue Station

Summary: *36th Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see Appendix B and figure 1).*

Description

36th Avenue Station is an elevated station with two straight side platforms. The platform structures are precast concrete. The width of the platforms is approximately 11'-0. There are two staircases at the center of each platform. The platforms are straight with a single row of columns supporting their respective station canopies. Column faces measure 4'-0" from their adjacent platform edges throughout. The canopies cover approximately half of the platforms. See figure 1 & 2 for reference.

***Figure 1** – Overall view*
36th Avenue Station

***Figure 2** – Precast concrete platforms*
36th Avenue Station

1.06 – MR 006 | 39th Avenue Station

Summary: *39th Avenue Station is not feasible for APGs or PSDs due to the elevated Precast T-Beam platform which has been deemed structurally insufficient to carry the load of a platform edge barrier system (see structural report; Appendix B and figure 1).*

Description

39th Avenue Station is an elevated station with two straight side platforms. The platform structures are precast concrete. There are two staircases at the center of each platform. The platforms are straight with a single row of columns supporting their respective station canopies the canopies cover approximately half of the platforms.

NOTE: Station specific dimensions and photographs could not be obtained at the time of this report due to station closure for rehabilitation.

1.07 – MR 007 | Lexington Avenue / 59th Street Station

Summary: *Lexington Avenue / 59th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met at all obstructions as the remaining width would be 30" (see figure 1).*

Description

Lexington Avenue / 59th Street Station is a below-grade station with one straight center / island platform. The platform structure is cast-in-place concrete. The width of the platform is approximately 20'-0" throughout. Columns are spaced 15' on center with column faces 4'-0" away from the platform edges. The walls at the end of platform are 45" from the platform edge. The implementation of a platform edge barrier would reduce this width to 30" or less* which would not allow for ADA compliant wheelchair movement. Please see **figure 1** for reference

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
Lexington 59th Street Station

1.08 – MR 008 | Fifth Avenue / 59th Street Station

Summary *Fifth Avenue / 59th Street Station is feasible for both APGs and PSDs. There is one ceiling mounted signal located at the center of each platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power capacity could not be ascertained due to inaccessibility during survey.*

Description

Fifth Avenue / 59th Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. Columns are spaced 15'-0" on center with column faces approximately 3'-6" from the platform edge. The southbound platform width is approximately 11'-10" throughout. The northbound platform width is approximately 11'-6" throughout. At the center of each platform there is one ceiling mounted signal located above the platform edge, with a vertical clearance of at least 7'-6". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage. Ceiling mounted signals located above the platform edge would need to be relocated in the implementation of full height PSDs. **(see Figure 3)**

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting

Equipment Room

The equipment room could be located at the west mezzanine flush to the wall (see **Figure 1, Figure 2**). The proposed room dimension is 27'-0" x 6-6".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

Reconstruction of the concrete platform edge will be required for the installation of an APG system due to the current platform edge condition rating. The 2012 NYCT conditions survey gave the platform edges an average rating of 2.75. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

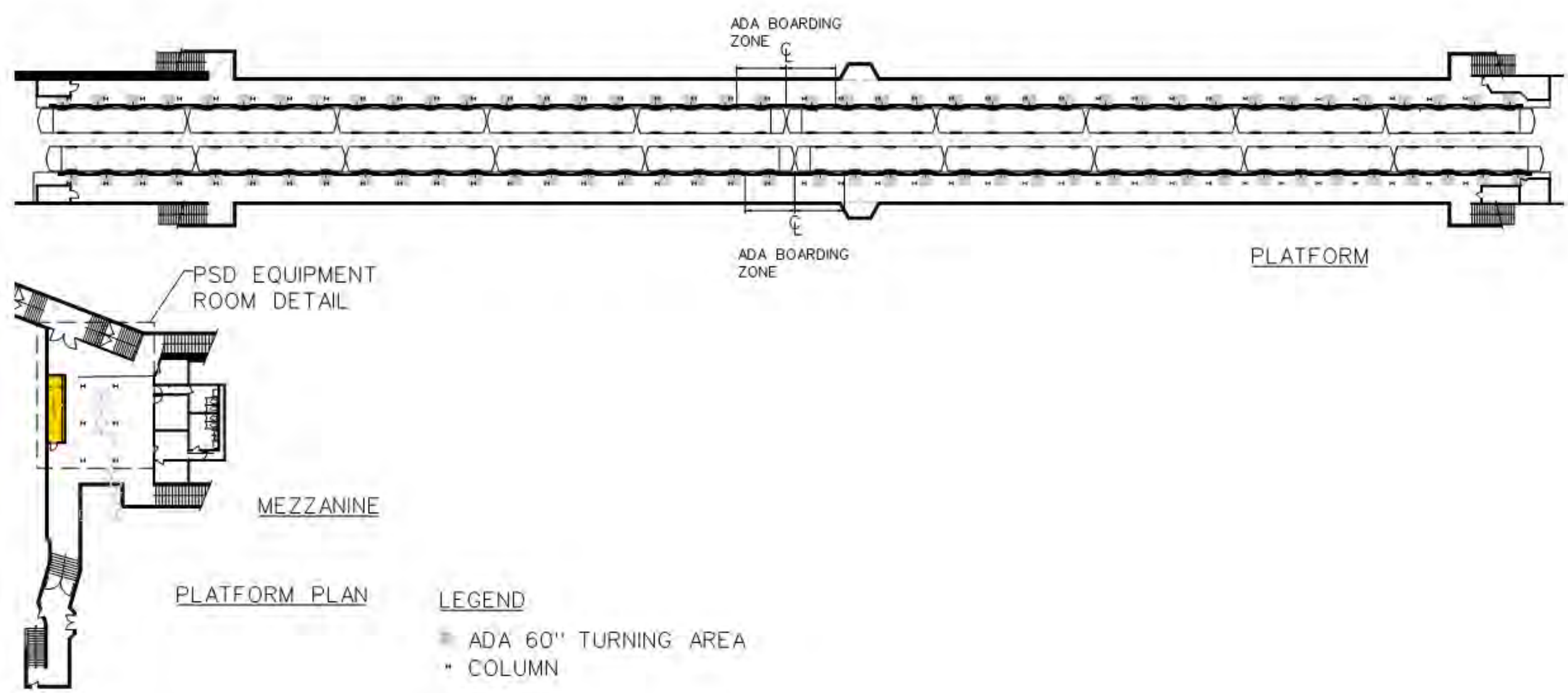

***Figure 1** – Overall Station Plan*
Fifth Avenue Station

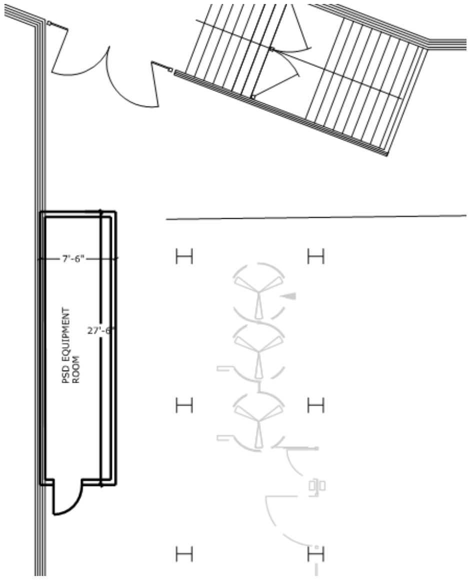

Figure 2 *– PSD Equipment Room Detail*
Fifth Avenue Station

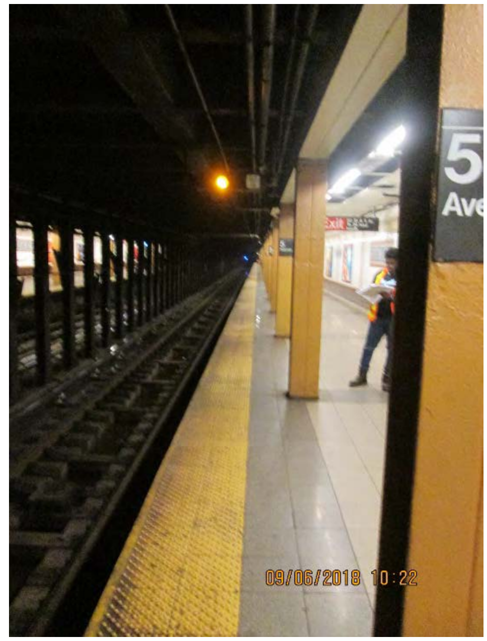

Figure 3 *– Signal above platform edge*
Fifth Avenue Station

Platform obstructions within 5' of edge:

Southbound Track:

- Columns

Northbound Track:

- Columns

Please note that in the ADA boarding zones, existing columns obstruct the 60" circle requirement discussed in the ADA summary in Appendix A. The installation of a PSD system would not further exacerbate these conditions.

Lighting:

Existing lighting: Throughout both platforms; linear florescent; parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

An analysis of adequate electrical power at this station could not be performed due to inaccessibility during survey. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $31.2M to install APGs and $40.0M to install PSDs (See Appendix E)

Figure 4 *– Typical Platform View*
Fifth Avenue Station

1.09 – MR 009 | 57th Street 7th Avenue Station

Summary: *57th Street 7th Avenue is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at the center stairs as the remaining width would be 27" (see figure 1).*

Description

The 57th Street Station is an underground station consisting of two center / island platforms. The platforms are approximately 19'-8" wide. The platforms are straight with two rows of columns at 42" from the edge of the platform. At four staircases columns flank the stair. The implementation of a platform edge barrier would reduce this width to 27" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-compliant ADA dimension*
57th Street Station

1.10 – MR 010 | 49th Street Station

Summary: *49th Street Station is feasible for both APGs and PSDs. There are two ceiling mounted signals located at the center of the southbound platform edge which would require relocation to implement a full height PSD system. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The 49th Street Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. There are no columns on the platforms. The platform width varies from approximately 7'-0" to 14'-8". On the southbound platform there are two ceiling mounted signals located above the platform edge, with a vertical clearance of at least 7'-6". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

***Half Height PSDs (aka APGs)*:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting

Equipment Room

The equipment room could be located as a split room, with one at the south control area of the southbound, and one located at the north control area of the southbound. (see **Figure 1, Figure 2**). The proposed room dimension are 16'-0" x 7'-6".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

Reconstruction of the concrete platform edge will be required for the installation of an APG system due to the current platform edge condition rating. The 2012 NYCT conditions survey gave the platform edges an average rating of 2.75. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

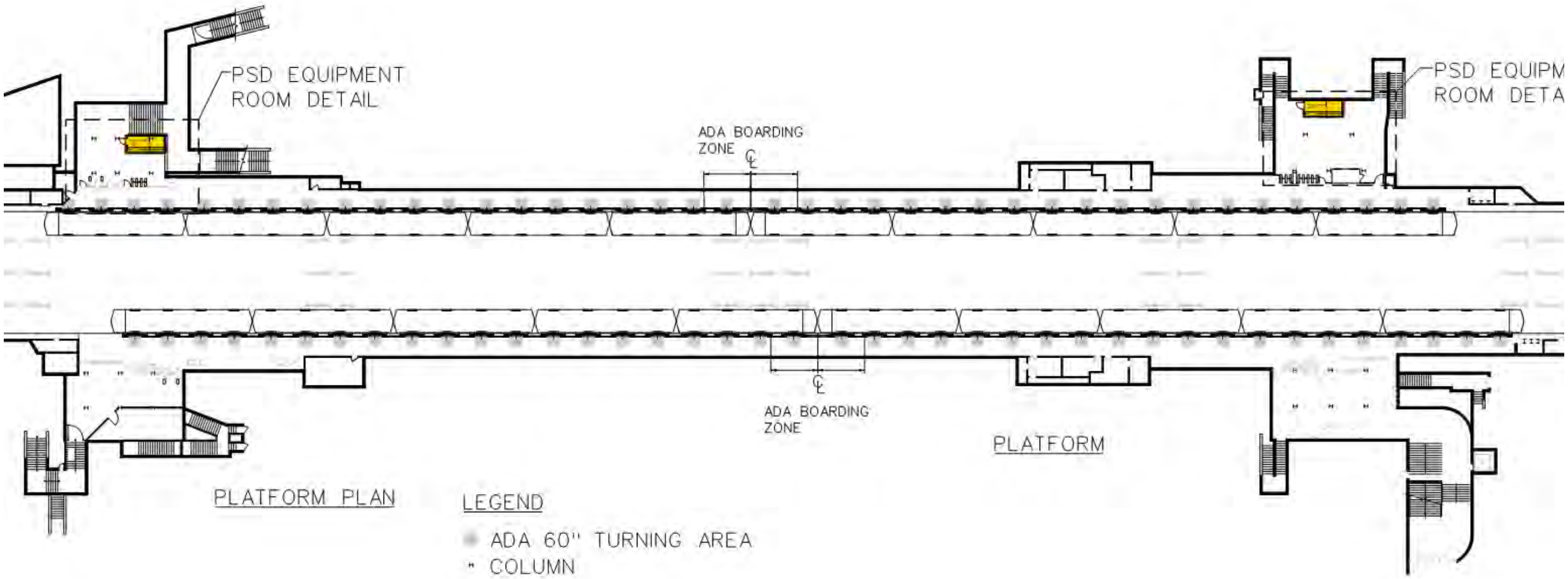

***Figure 1** – Overall plan*
49th Street Station

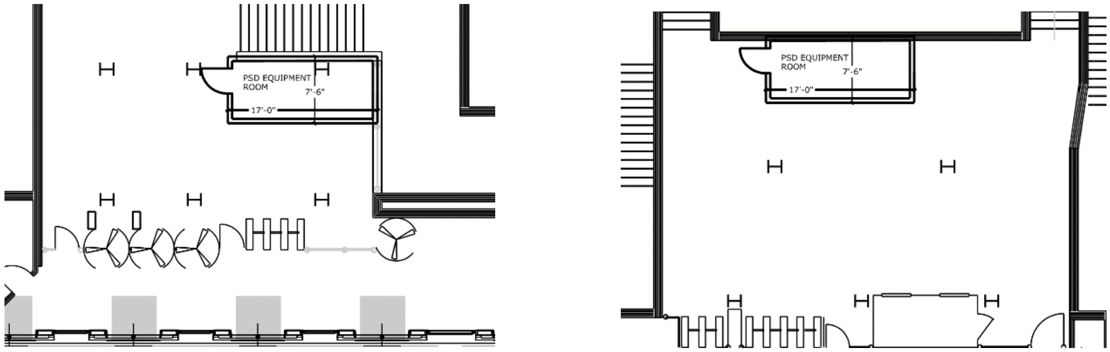

Figure 2 *– PSD Equipment Room Detail*
49th Street Station

Platform obstructions within 5' of edge:

None

Lighting:

Existing lighting: Throughout both platforms; linear fluorescent; perpendicular to the platform edge mounted in the ceiling coffers. No lighting reconfiguration will be required as part of a PSD installation.

Figure 3 *– General platform view*
49th Street Station

Power:

This station has adequate capacity to support the implementation of a APG/PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Table 1 please see the Power Capacity Analysis for this station.

Station
Power Capacity Analysis

Station Name	49th Street
Peak Demand Load from ConEd Report, Last **12** Months, (kW)	45.2
Apparent Power (kVA)	56.5
Station Peak Demand Load, Max Current, (A)	156.9
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	352
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	449
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. This analysis is for **Normal service**. Meter reading is for 12 months.

**Station
Power Capacity Analysis**

Station Name	49th Street
Peak Demand Load from ConEd Report, Last 12 Months, (kW)	27.2
Apparent Power (kVA)	34.0
Station Peak Demand Load, Max Current, (A)	94.5
Maximum Amount of Doors	80.0
PSD Total Load Including All Miscellaneous Loads, (A)	194.6
Total Load (Station Peak + PSD), (A)	289
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	511
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. This analysis is for **Reserve service**. Meter reading is for 12 months.

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $33.5M to install APGs and $43.5M to install PSDs (See Appendix E)

1.11 – MR 011 | Times Square / 42nd Street Station

Summary: *Times Square / 42nd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 19" (see figure 1). (Note: this report covers only the Broadway BMT platforms; see reports for the Shuttle, 7, 1,2,3-line for the remainder of the station)*

Description

Times Square / 42nd Street Station is a below-grade station consisting of two center / island platforms. The platform width is 19-4" throughout. The platforms are straight with two rows of columns at 3'-8" from edge of platform. At the south end of the platforms, the columns flanking an equipment room are 2'-10" from the platform edge. The implementation of a platform edge barrier would reduce this width to 19" or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** –platform*
42nd Street / Times Square Station

1.12 – MR 012 | 34th Street / Herald Square Station

Summary: *34th Street / Herald Square Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32” minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 25” (see figure 1). (Note: this report covers only the Broadway BMT platforms; see the B, D, F, M-line report for the remainder of the station)*

Description

34th Street / Herald Square Station is a below-grade station consisting of two center / island platforms. The platform width is 19-8” throughout. The platforms are straight with two rows of columns at 3’-4” from edge of platform. On the center / island platform the columns flank multiple staircases. The implementation of a platform edge barrier would reduce this width to 25” or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *–platform*
34th Street Station

1.13 – MR 013 | 28th Street Station

Summary: *28th Street Station is not feasible for both APGs and PSDs due to lack of available space for the PSD equipment room.*

Description

28th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns 3'-6" from the platform edge at each platform, though approximately one third of the platform is column-free. The platform width varies from 6'-0" to 9'-5. Due to the extremely limited width of the existing platforms and control areas, there is no available space for the equipment room. Figure 2, below, shows the minimum width required for construction of a PSD equipment room if placed on the platform. Figure 1, below, demonstrates the lack of available space within the southbound control area. The northbound control area is similar..

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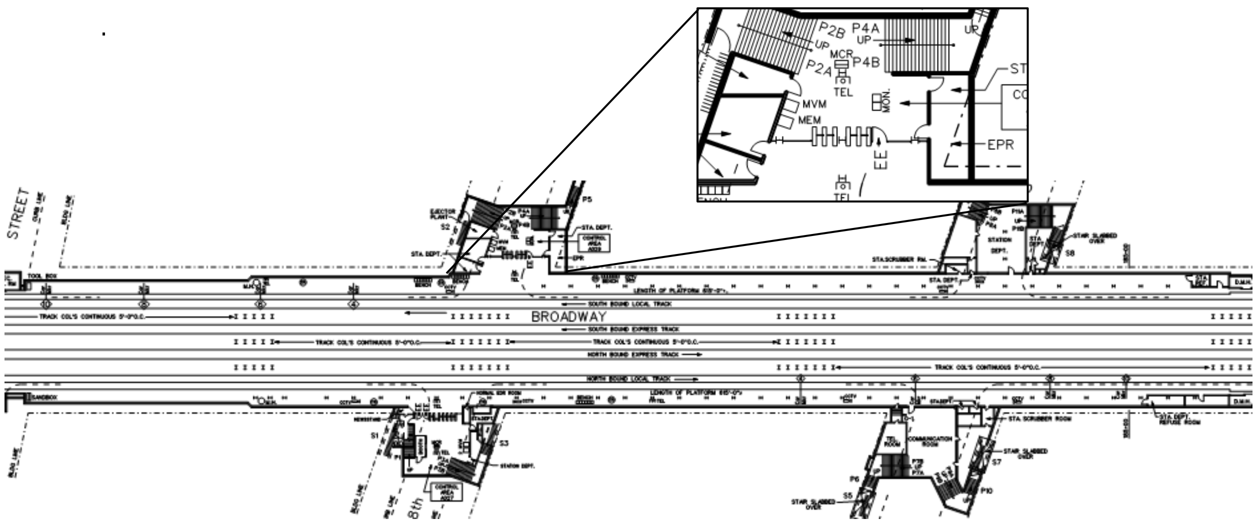

***Figure 1** – Station Plan- 28th Street Station*

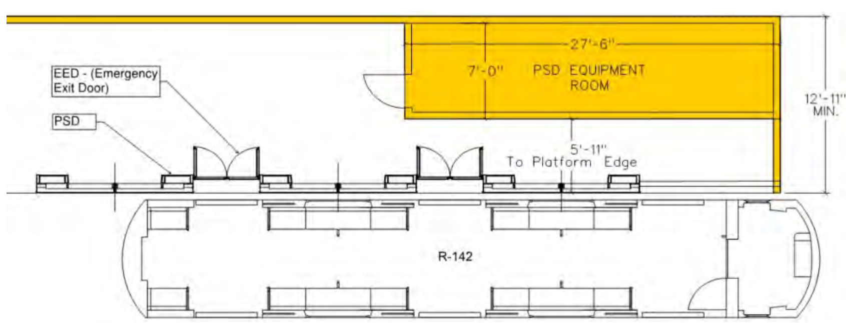

***Figure 2** – Diagram demonstrating minimum platform width dimensions*
(A Division train shown; B Division requires same dimensions)

1.14 – MR 014 | 23rd Street

Summary: *23rd Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at the northbound platform control area as the remaining width would be 27" (see figure 1).*

Description

23rd Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns 3'-8" from the platform edge at each platform. The platform width varies from 6'-0" to 11'-2" in width. The entry / exit turnstiles at the south entrance of the northbound platform are positioned with minimal clearance of 18" to the adjacent columns. The remaining space between the columns and the platform edge measures 42". The implementation of a platform edge barrier would reduce this width to 27" which would not allow for ADA compliant wheelchair movement. See figures 1and 2 below. The plan in figure 1 demonstrates that there is no alternative location for the turnstiles / railings.

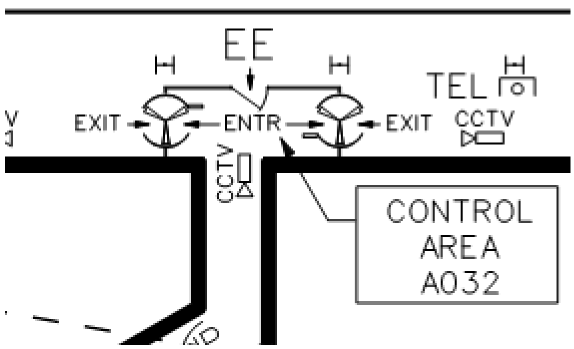

***Figure 1** – Non-Compliant ADA condition - 23rd Street*

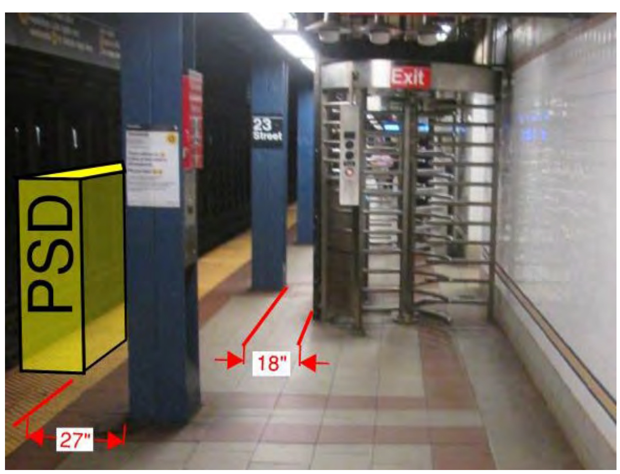

***Figure 2** – Non-Compliant ADA condition - 23rd Street*

1.15 – MR 015 | 14th Street / Union Square Station

Summary: *14th Street / Union Square Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 27" (see figure 1). (Note: this report covers only the Broadway BMT platforms; see reports for the L-line and 4,5,6-line for the remainder of this complex)*

Description

14th Street / Union Square Station is a below-grade station consisting of two center / island platforms. The platform width is 18-8" throughout. The platforms are straight with two rows of columns at 3'-6" from edge of platform; these columns flank multiple staircases. The implementation of a platform edge barrier would reduce this width to 27" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
14th Street / Union Square

1.16 – MR 016 | 8th Street Station

Summary: *8th Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1).*

Description

8th Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. There is a single row of columns 3'-4" from the platform edge at each platform. The platform width varies from 9'-6" to 11'-0" in width. The south street stair at each platform is positioned with minimal clearance to the adjacent columns. The remaining space between the columns and the platform edge measures 40". The implementation of a platform edge barrier would reduce this width to 25" or less* which would not allow for ADA compliant wheelchair movement. See figure 1 below.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

***Figure 1** – Non-Compliant ADA condition*
8th Street Station

1.17 – MR 017 | Prince Street Station

Summary: *Prince Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 21" (see figure 1).*

Description

Prince Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 7'-6' to 8'-8". Platform width at the south end of the southbound platform is 36". The implementation of a platform edge barrier would reduce this width to 21" or less below the required minimum of 36". The remaining 21" or less* would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
Prince Street

1.18 – MR 018 | Canal Street Station

Summary: *Canal Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" minimum corridor requirement for ADA complaint wheelchair movement would not be met as the remaining width would be 33" (see figure 1). (Note: this report examines only the upper platforms at this station. See the N-line report for the lower platforms)*

Description

Canal Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 7'-0' to 11'-8". Platform width at the south end of the northbound platform is 48". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 33" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
Canal Street Station

1.19 – MR 020 | City Hall Station

Summary: *City Hall Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 25" (see figure 1).*

Description

City Hall Station is a below-grade station with a center / island platform. The platform structure is cast-in-place concrete. The platform width varies from 23'-8" to 46'-4". There are four lines of columns, with those adjacent to the track being 3'-4" from the platform edge. Ceiling heights measure no less than 7'-6" throughout. At the stair to the lower level, clearance along the platform edge is constricted by columns subdividing the space into two narrow widths. The available 40" width between columns and platform edge will be further constricted by the introduction of PSDs, reducing the width to 25" or less* which would not allow for ADA compliant wheelchair movement. See Figure 1 below.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
City Hall Station

1.20 – MR 021 | Cortlandt Street Station

Summary: *Cortlandt Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant egress conditions. In the implementation of a platform edge barrier, the 5'-11" minimum corridor requirement for evacuation would not be met at the south end of the northbound platform as the existing width is 5'-3"" (see figure 1).*

Description

Cortlandt Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 5'-3' to 19'-8". There are two ceiling-mounted signals at each platform at a minimum 6'-11" clearance.

Platform width at the south end of the northbound platform is 5'-3". With the installation of PSDs, this dimension will be reduced to 48" *. Our station egress analysis (attached as Appendix C) finds that 5'-11" is a minimum side platform width which will not impede egress via emergency exit doors with an installed PSD system. See figure 1 for reference.

*Please note that the egress clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant code condition*
Cortlandt Street Station

1.21 – MR 022 | Rector Street Station

Summary: *Rector Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at the northbound control area as the remaining width would be 25" (see figure 1).*

Description

Rector Street Station is a below-grade station with two straight side platforms. The platform structures are cast-in-place concrete. The width of the platforms ranges from 10'-2' to 11'-8". At the turnstile line on the northbound platform, clearance between the turnstiles and the row of columns is only 20". At this area there is 40" between the columns and the platform edge. The implementation of a platform edge barrier would reduce this width below the required minimum of 32" for a pinch point. The remaining 25" would not allow for ADA compliant wheelchair movement. See figure 1 for reference. The plan of this area shown in Figure 2 reveals the constrained conditions within the unpaid area and demonstrates that there is no available space for reconfiguration of turnstiles to ameliorate the non-compliant conditions.

***Figure 1** – Non-Compliant code condition*
Rector Street Station

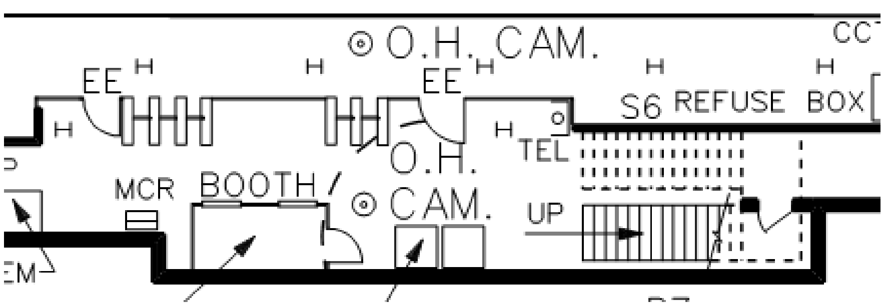

***Figure 2** – Constrained control area; northbound platform*
Rector Street Station

1.22 – MR 023 | Whitehall Street Station

Summary: *Whitehall Street Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 32" minimum pinch point requirement for ADA complaint wheelchair movement would not be met at all stairs as the remaining width would be 21" (see figure 1).*

Description

Whitehall Street Station is an underground station consisting two center / island platforms. The platforms are approximately 12'-6" wide throughout. At four staircases, columns flank the stair, leaving a dimension of 36" between the column and the platform edge. The implementation of a platform edge barrier would reduce this width to 21" or less* which would not allow for ADA compliant wheelchair movement nor passenger movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.

Figure 1 *– Non-Compliant ADA condition*
Whitehall Street Station

1.23 – MR 461 | Queensboro Plaza Station

Summary: *Queensboro Plaza Station is feasible for APGs only. The "7", "N" and "W" trains are served on both the upper & lower levels, with the 7 train and N/W trains on opposite sides of the center / island platforms. The No. 7 sides of these platforms are the subject of a separate station report. Full height PSDs are infeasible due to low beams above the platform edge at the upper level platform. Platform edge reconstruction will be required to support an APG system (see Appendix B). Existing power is adequate.*

Description

Queensboro Plaza Station is elevated with two straight center / island platforms stacked on top of each other. See figure 1 for an overall station plan. Both platforms are made of cast-in-place concrete. On the southbound platform, columns are spaced 48' on center with column faces 4'-8" from the platform edge. On the lower platform, columns are spaced 24' on center with column faces 2'-2" from the platform edge. Both platforms are approximately 19'-6" wide. On the lower platform, there is a vertical clearance of approximately 8'-0", which reduces to 7'-2" at the east-end of the platform. On the upper platform, there is a vertical clearance of approximately of 7'-2" to canopy beams at the platform edge.

Full Height PSDs: Full height PSDs are infeasible due to the low beams of the canopy at the upper level platform. The bottom of the existing beams are at 7'-10", whereas PSD manufacturers require 8'-6" of height.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, entrapment prevention sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be CCTV cameras over each motorized sliding door which will need to be located in coordination with existing or replacement lighting. Wall mounted conduits below the upper and lower platform edge would need to be relocated to accommodate the requirements of the APG system. Minimal overhead structure would be needed to accommodate cameras and sensors in the small portion of the platforms not covered by canopies

Equipment Room

One room can be accommodated at the eastern end of the upper platform. The proposed room would measure approximately 27' x 7'-6" (see figure 2). As there are four platform edges at this station (including the No. 7 train), two equipment rooms would be needed to accommodate all of the required equipment. An additional room can be located in a similar location on the lower platform.

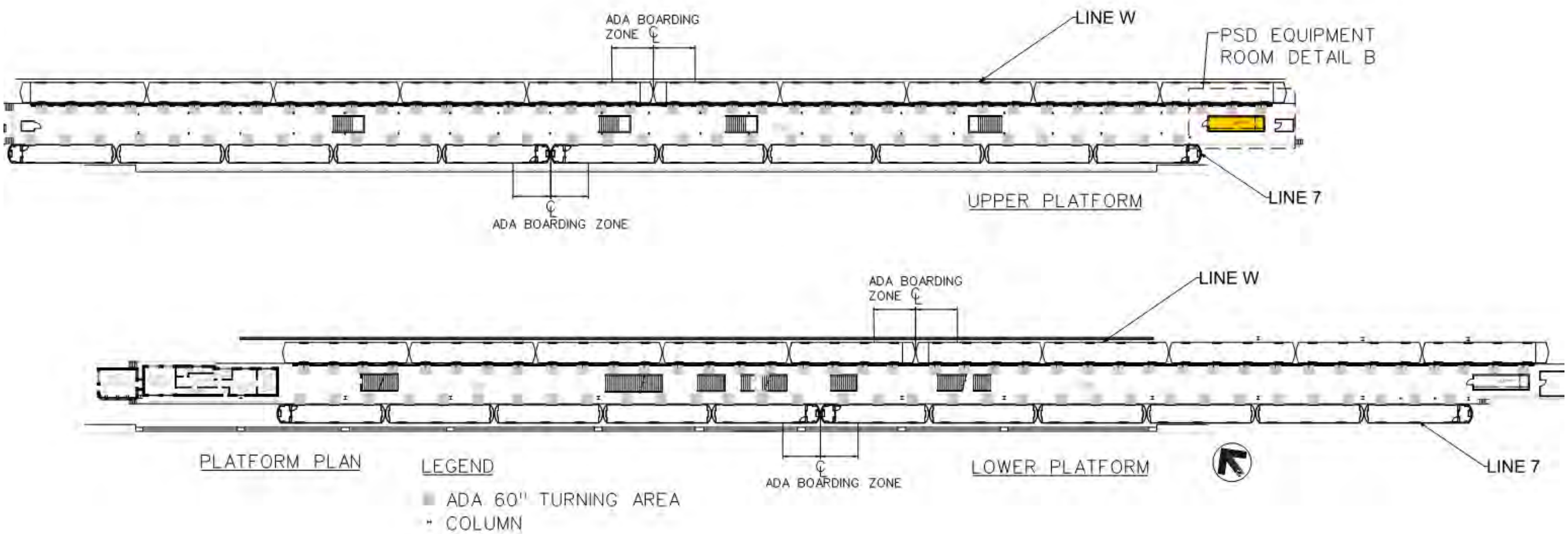

Figure 1 *– Platform plans*
Queensboro Plaza Station

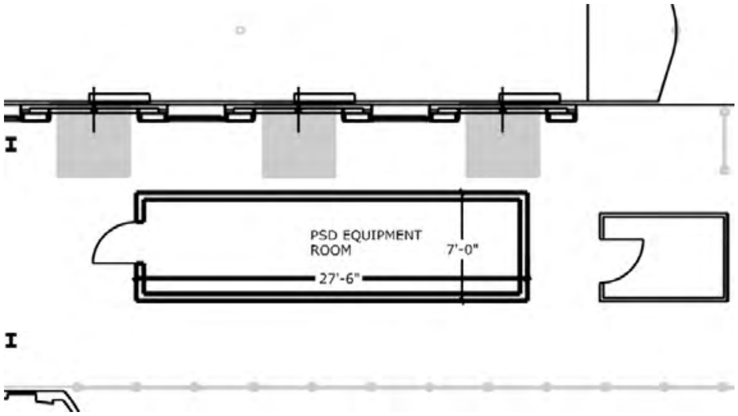

***Figure 1** – Equipment Room detail*
Queensboro Plaza Station

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform edge condition

From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations of the last thirty years, platform edge reconstruction would only be required for the installation of an APG system. The 2012 NYCT conditions survey gave the platform edges an average rating of 2.6. On a scale of 1 to 5, a rating of 1 indicates no apparent deterioration and 5 indicates that the observed deterioration will require immediate repair.

Platform obstructions within 5' of edge:

- Southbound (lower) platform:
  - All columns are 26" from the Hudson Yards platform edge.
- Northbound (upper) platform:
  - All columns are 51" from the platform edge.

These obstructions do not present an impediment to the installation of PSDs.

.

Lighting:

Existing lighting: Linear fluorescent; approximately 1' from platform edge for southbound and centered under canopy on the northbound platform. Depending on the specific APG / PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate electrical capacity (only from the Normal service) to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.

Below in Table 1 please see the Power Capacity Analysis for this station.

**Station
Power Capacity Analysis**

Station Name	Queensboro Plaza
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	118.4
Apparent Power (kVA)	148.0
Station Peak Demand Load, Max Current, (A)	411.1
Maximum Amount of Doors	146.0
PSD Total Load Including All Miscellaneous Loads, (A)	315.0
Total Load (Station Peak + PSD), (A)	726
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	74
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. This analysis is for **Normal service**. Total doors: 146. {'W'-80 + '7'-66}

Station
Power Capacity Analysis

Station Name	Queensboro Plaza
Peak Demand Load from ConEd Report, Last 20 Months, (kW)	163.2
Apparent Power (kVA)	204.0
Station Peak Demand Load, Max Current, (A)	566.7
Maximum Amount of Doors	146.0
PSD Total Load Including All Miscellaneous Loads, (A)	315.3
Total Load (Station Peak + PSD), (A)	882
Station Service Power Capacity, (Main SB or SG Rating), (A)	800
Service Spare Capacity, (A)	0
Is Electrical Service Adequate?	**No**
Notes	Service rating is based on the 1 line diagram, having 800A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service. This analysis is for Reserve **service**. Total doors: 146. {'W'-80 + '7'-66}

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $33.1M to install APGs. (See Appendix E)

Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*
>
> a. *Column location in relation to the platform edge*
> b. *Platform edge clearance adjacent to stairs and other impediments*
> c. *Impacts to ADA path of travel and boarding areas*
> d. *Conflicts of PSD/APG/RPSDs with Signals cables*
> e. *Sufficient platform width*
> f. *Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*
>
> a. *Structural capacity of platforms to accept PSD/APG/RPSDs*
> b. *Feasibility & location for PSD/APG/RPSDs equipment room*
> c. *Confirmation of adequate power for PSD/APG/RPSDs*
> d. *Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> e. *Determination of communications requirements, availability and cost*
> f. *Determination of gap detection and entrapment avoidance technology requirements*
> g. *Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
    - Double the amount of motors as PSDs (each motor operating a single leaf).
    - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
    - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
    - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		PSDs	APGs	RPSDs	Grading system
General Factors	Specific Subfactors				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	Comments
Platform Screen Doors (PSDs) (> 8’ in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

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If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

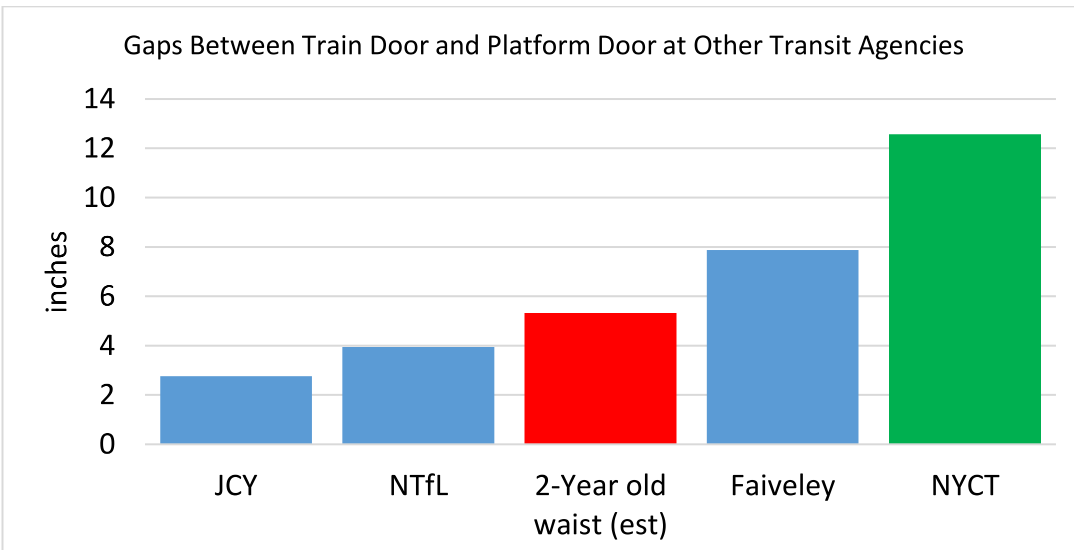


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

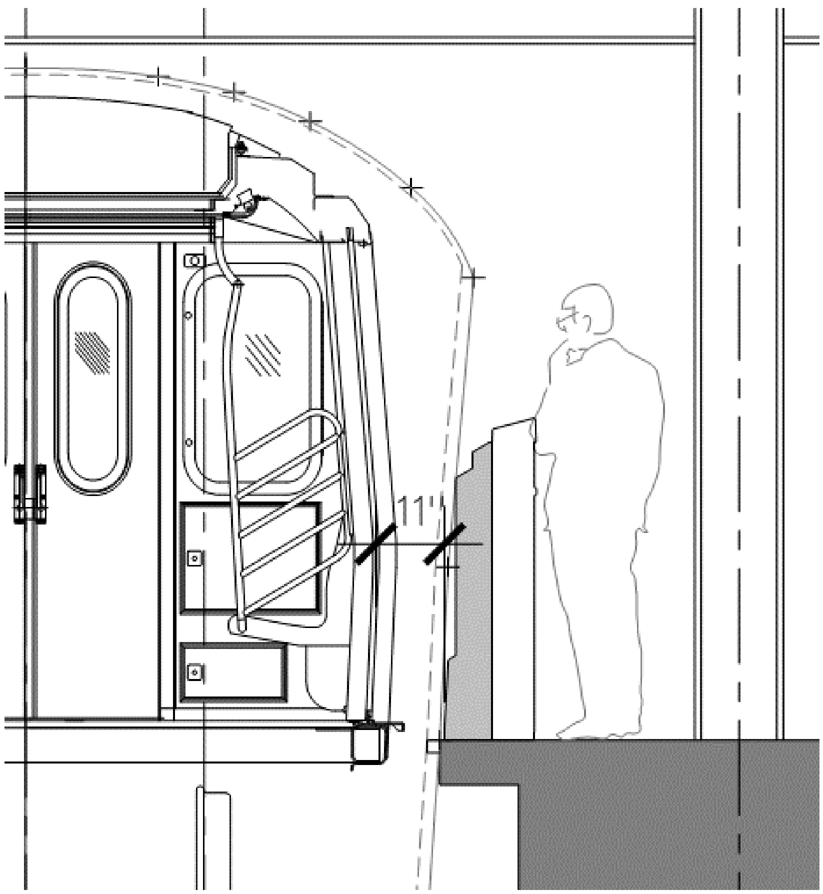


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber "bumpers" on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6" into the line equipment envelope. This would leave a 5" gap between the platform and car doors allowing approximately 2" of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5” by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor’s window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor’s window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **<u>bold/underline</u>**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	PSD System 1	PSD System 2	PSD System 3
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Station Capacity Analysis	**3rd Ave.**	**6th Ave.**	**14 St / Union Square**	**1st Ave.**
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are "existing" as defined by code. All the rolling stock is also to be considered "existing" under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60" radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36" of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

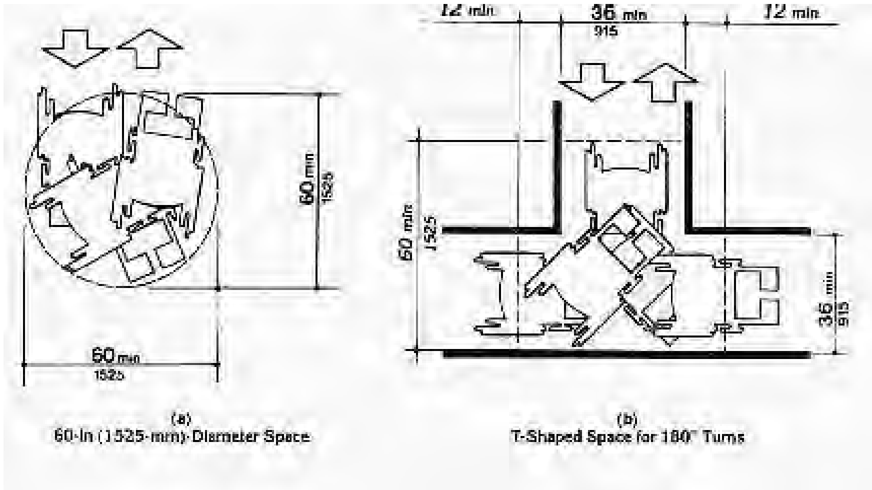
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36” which may be constricted to 32” at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

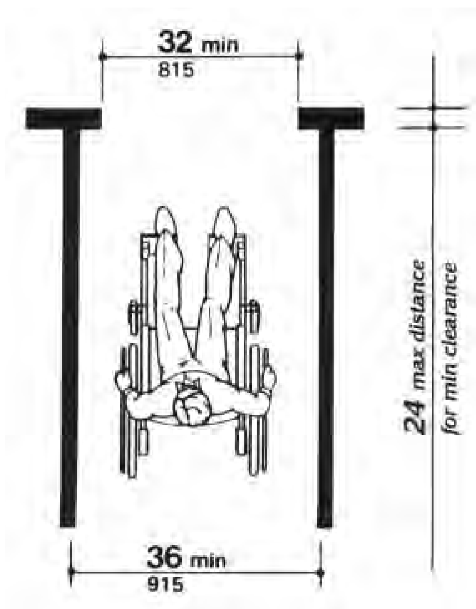


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

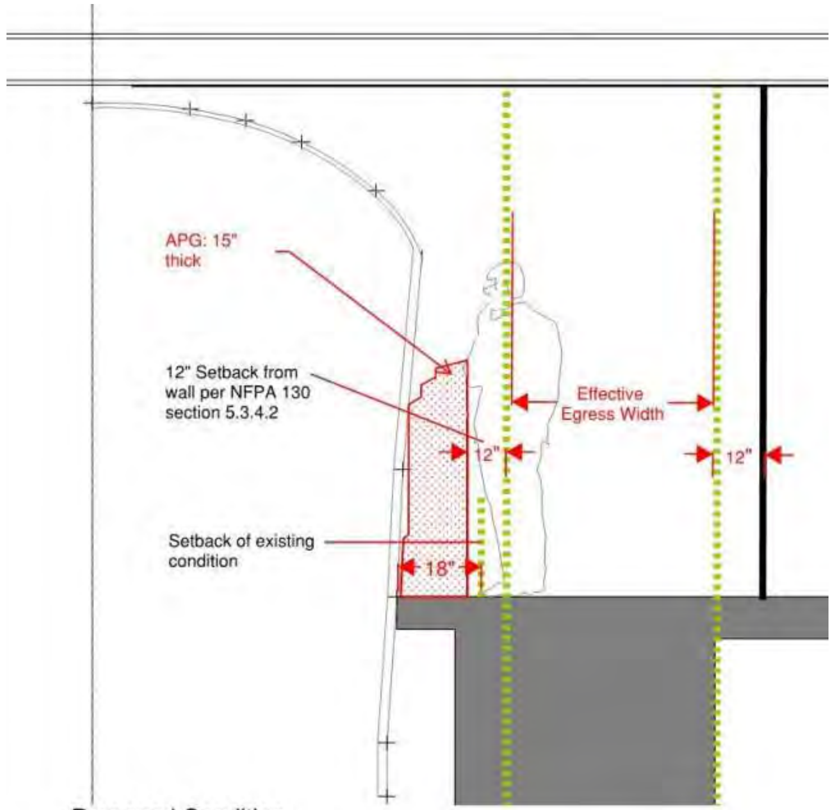
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15” of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

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Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

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DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

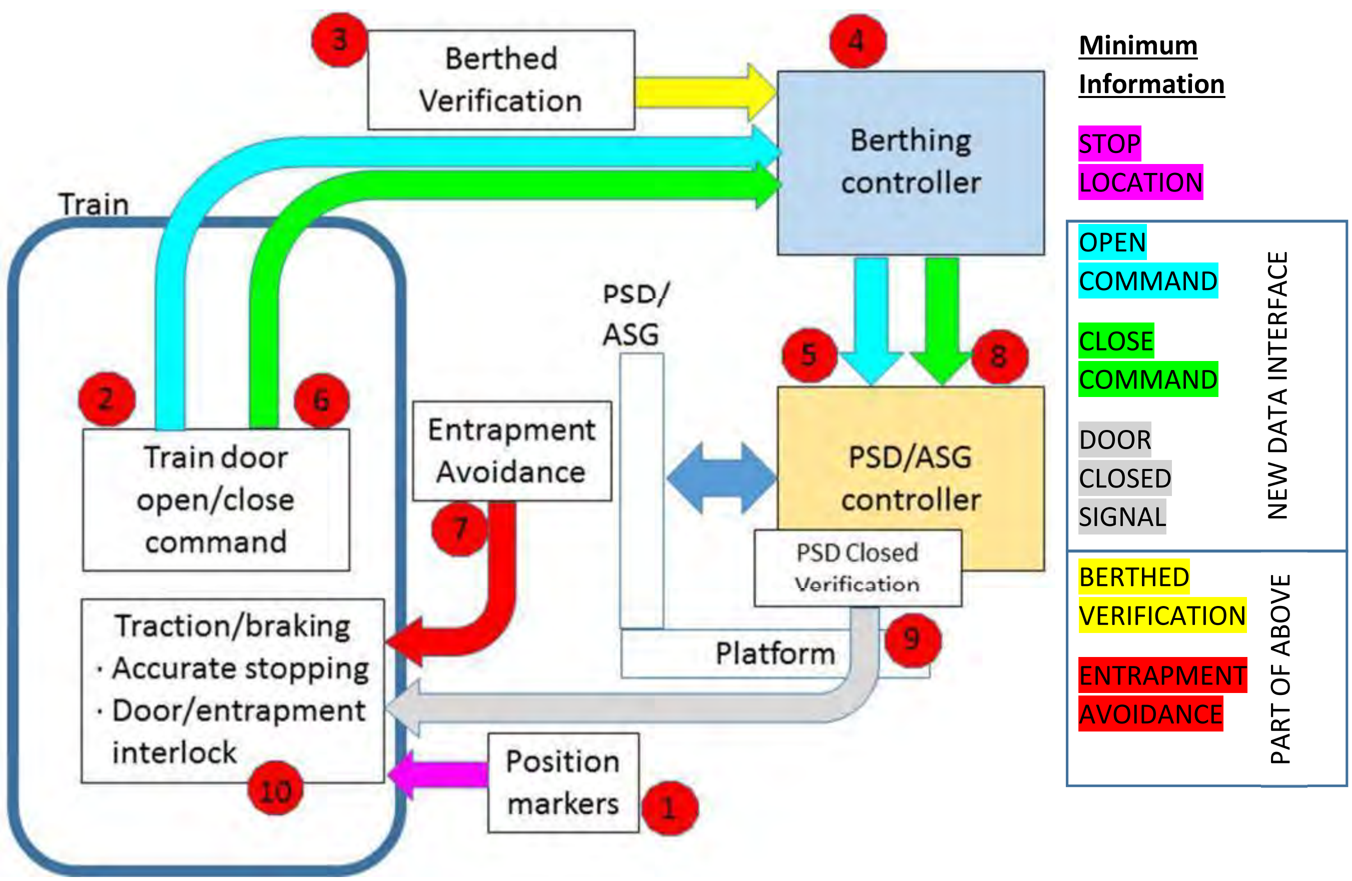
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



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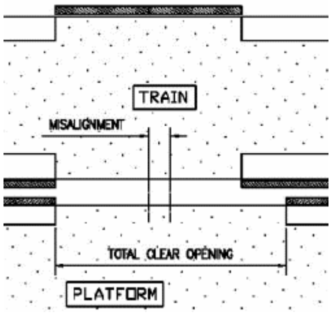
Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5” clear opening, a design for NY should meet the ADA Accessibility Guideline of 36”.

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a ‘distance totem’ which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy’s COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically

If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.

For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4'-0"). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

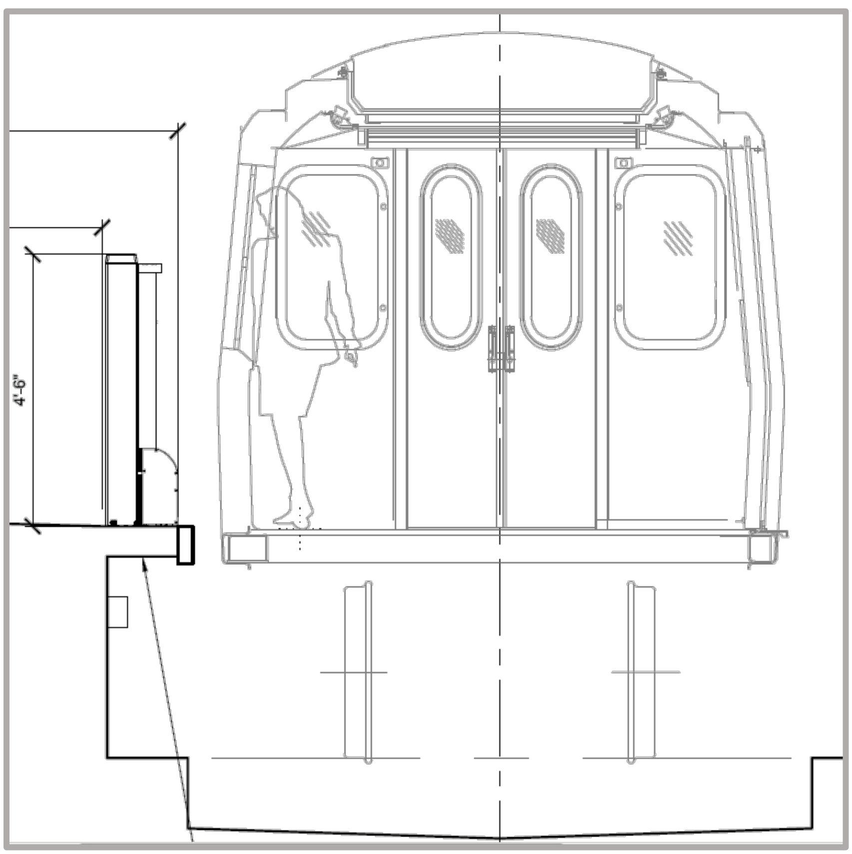


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the “wind” load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers’ requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1” thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

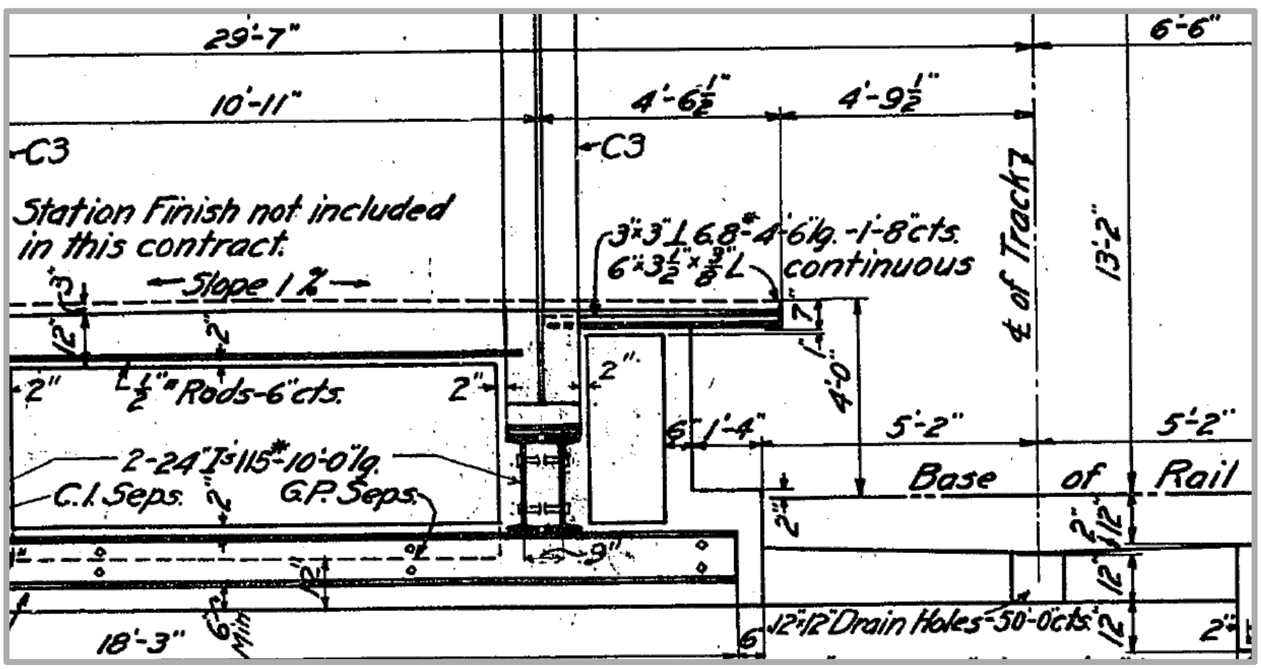


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

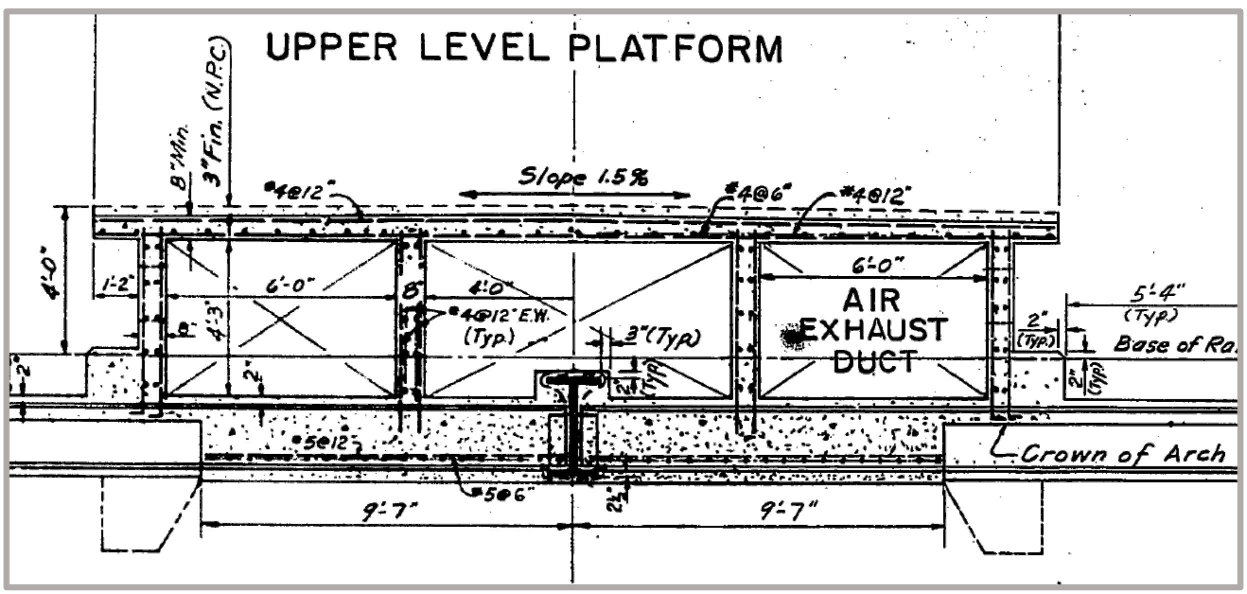


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

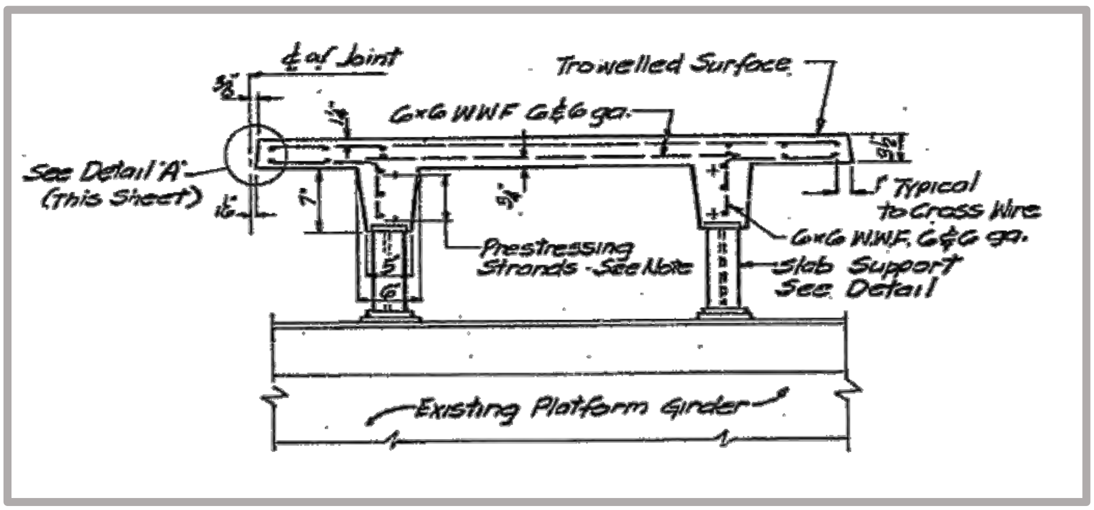


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

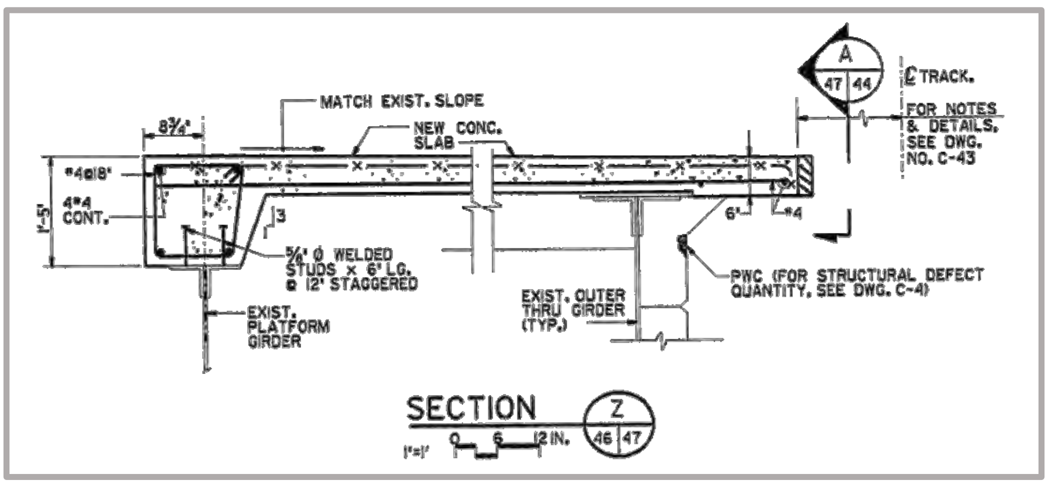


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2'-9"), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

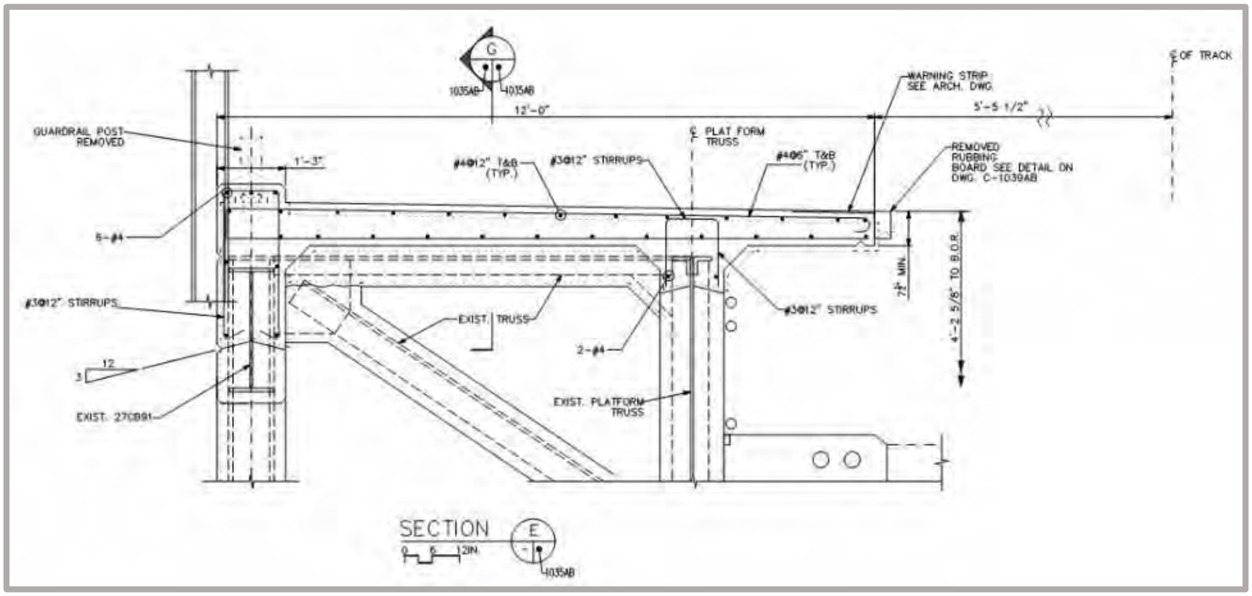


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3" thick structural slab with an approximately 3" thick topping slab. If the topping slab is fully removed, a 6" thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6" thick slab will be sufficient for a cantilever length of up to approximately 3'-0", greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6" structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6" minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

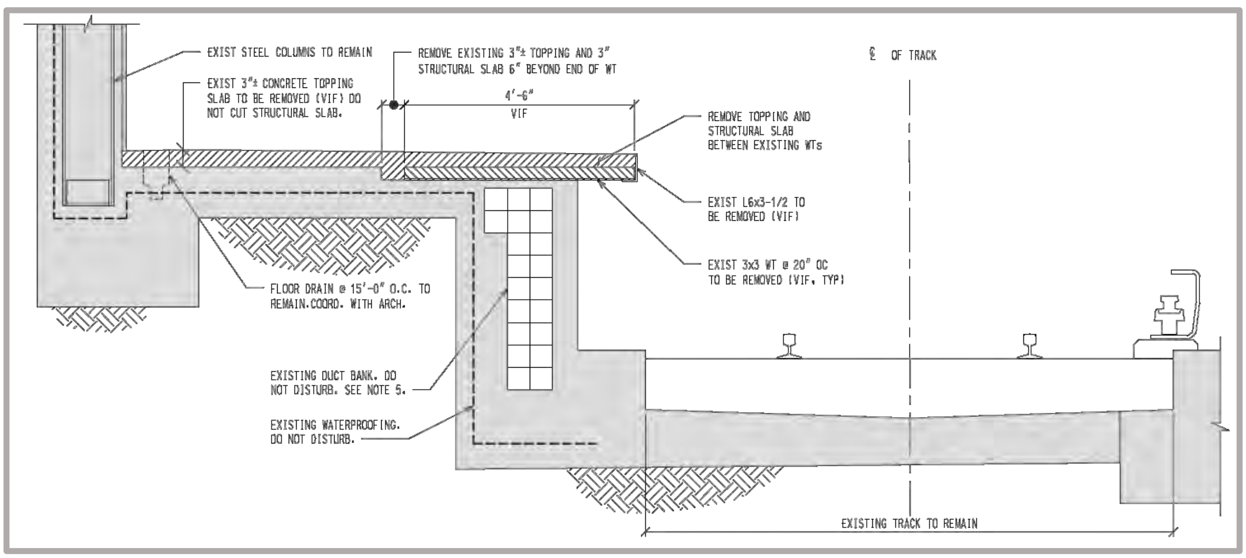


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

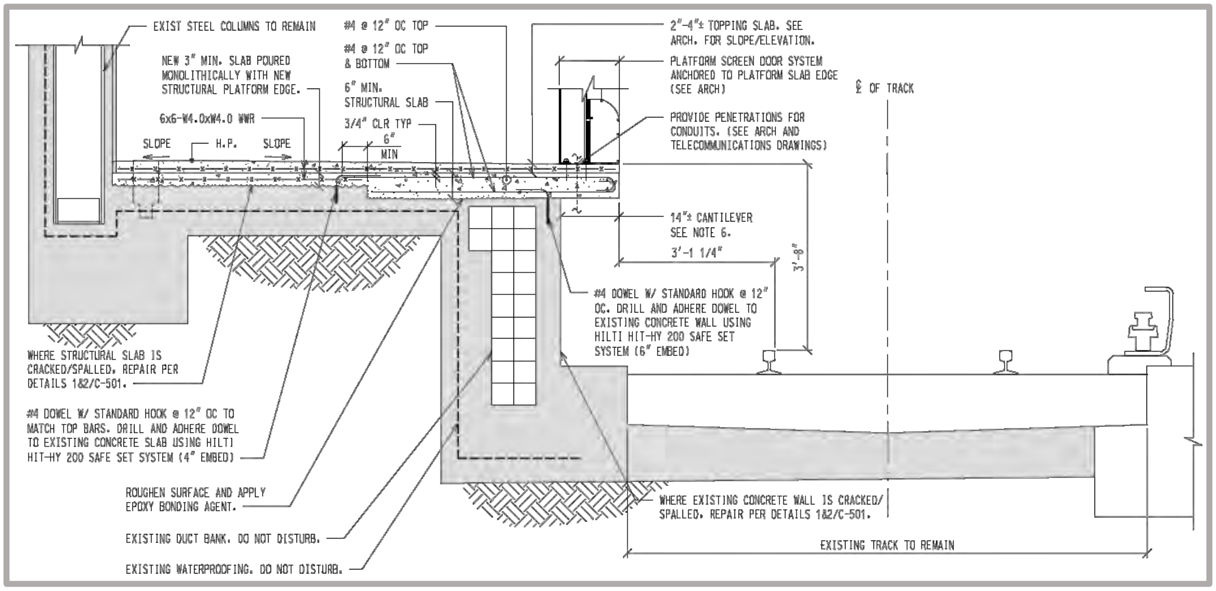


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

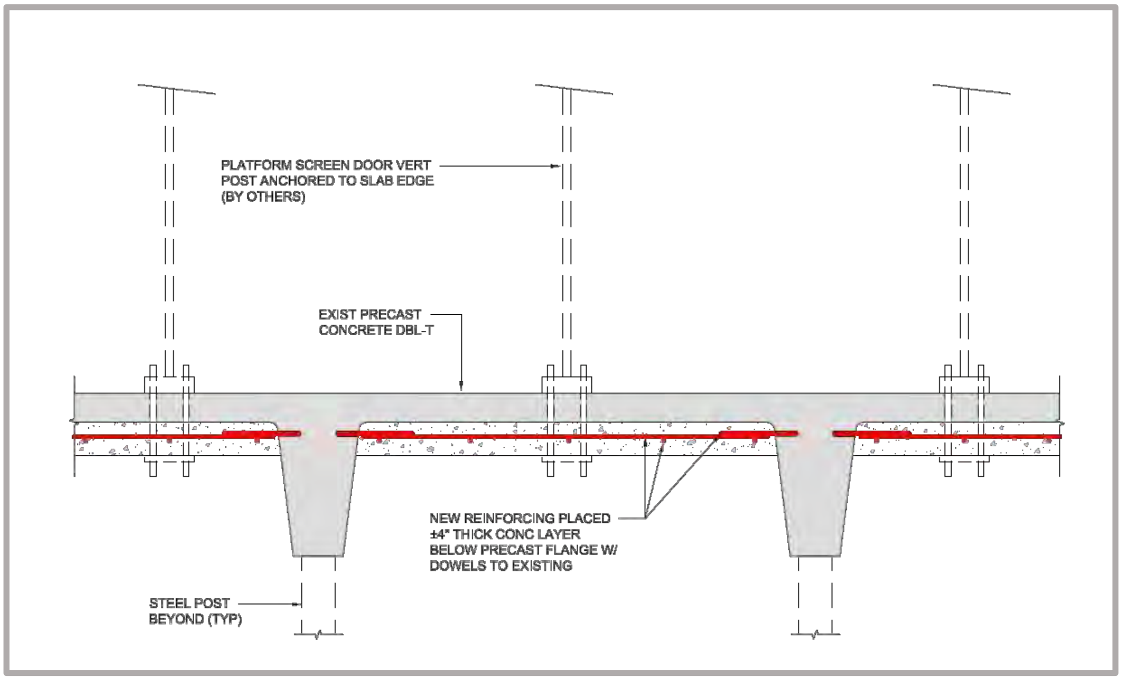


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5' – 11" of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis

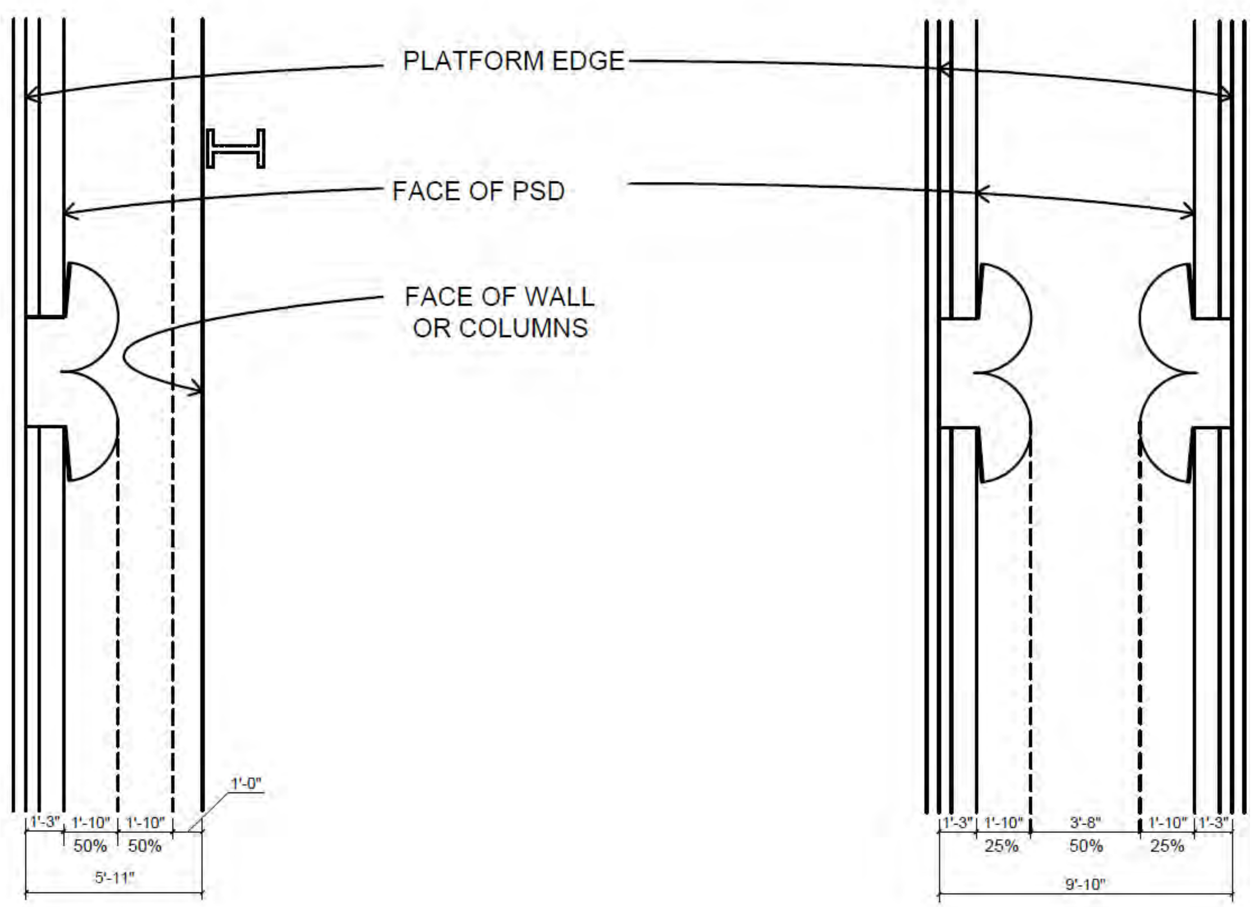


FIGURE 1: SIDE PLATFORM

FIGURE 2: CENTER PLATFORM

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

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MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the	9	$ 63,500 per month [Year 01]	$ 571,500		
	platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance	12	$ 83,590 per month [Year 02]	$ 1,003,080		
	since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
	remedial repair performed as needed, 24/7, for the	12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
	platform screen door system and ancillary equipment.					
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663		

ITEM NO.	DESCRIPTION		RATE	
7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *	
		Year 3	$ 257 per hour *	
	Optional :	Year 4	$ 268 per hour *	
	Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

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ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations
ESTIMATE DATE:	January 7, 2019

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

MTA/NYCT

January 7, 2019

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.2 *APGs / PSDs will provide 39 emergency egress doors with push bars per platform*
1.3 *Each platform edge will have 40 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10” x 10” H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 It is assumed that each train has 10 cars on this line
2.2 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.3 In respect of the PSD option, only platforms that have not been upgraded in the recent past will require platform edge replacement.
2.4 There are no special security requirements made necessary by installation of the APG system
2.5 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.6 This estimate does not provide for the replacement of Platform Edge Lighting
2.7 Premium cost for night time work is considered 50% of total labor cost

3.0 ***Exclusions - Costs not included in the estimate:***

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VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

MTA/NYCT

January 7, 2019

BASIS OF ESTIMATE

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems
3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length
3.4 Costs associated with NYCT State Of Good Repair improvements to the station
3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.
3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs
3.7 Escalation Cost is not included; Anticipate at 5% per annum.
3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.
3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium
3.10 NYCT project cost is not included
3.11 GO and flagging cost is not included
3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or "soft" costs:***

4.1 Design and Construction Contingency
4.2 Contractor O & P
4.3 Insurance
4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 Given the limited time available, no drawings were developed to support this estimate.

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MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

Jan 7, 2019

ORDER OF MAGNITUDE COSTS			MRN 461	MRN 008	MRN 010
DESCRIPTION			QUEENSBORO PLAZA	5TH AVE./59TH ST.	49TH STREET
1	AUTOMATIC PLATFORM GATES (APG'S)		$17,522,627	$16,516,828	$17,737,576
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$17,522,627	$16,516,828	$17,737,576
4	GENERAL REQUIREMENTS	15.00%	$2,628,394	$2,477,524	$2,660,636
	SUB-TOTAL:		$20,151,021	$18,994,352	$20,398,212
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$5,037,755	$4,748,588	$5,099,553
	SUB-TOTAL:		$25,188,777	$23,742,940	$25,497,765
6	OVERHEAD & PROFIT	15.00%	$3,778,316	$3,561,441	$3,824,665
	SUB-TOTAL:		$28,967,093	$27,304,381	$29,322,430
7	BONDS & INSURANCE	3.75%	$1,086,266	$1,023,914	$1,099,591
	SUB-TOTAL:		$30,053,359	$28,328,295	$30,422,021
	SUB-TOTAL:		$30,053,359	$28,328,295	$30,422,021
	SUBTOTAL CONSTRUCTION COST W/O ACM		**$30,053,359**	**$28,328,295**	**$30,422,021**
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		**$30,053,359**	**$28,328,295**	**$30,422,021**
10	DESIGN CONSULTANT FEES	10.00%	$3,005,336	$2,832,829	$3,042,202
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		$33,058,695	$31,161,124	$33,464,223
	ADD ALTERNATIVES				
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		N/A	4,697,318	5,331,194
	Add for Markups (as above)	88.66%	N/A	4,164,778	4,726,791
	SUB-TOTAL PSD ALTERNATIVE		N/A	$8,862,097	$10,057,985
	TOTAL PROJECT COST (PSD OPTION)		N/A	$40,023,221	$43,522,208

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

7-Jan-19

STATION : QUEENSBORO PLAZA

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE UPPER PLATFORM EDGE=	622	LF		
5	LENGTH OF THE LOWER PLATFORM EDGE =	684	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,306**	**LF**		
7	NUMBER OF TRAIN CARS ON W TRAIN TRACK =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,306	LF	7	9,142
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,530	SF	12	78,360
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	132	CY	2,500	330,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,308	EA	25	32,700
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,308	EA	25	32,700
19	Cast in assemblies for PSD holding down bolts	320	EA	180	57,600
20	Polyethylene edge strip	1,306	LF	95	124,070
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,306	LF	15	19,590
26	Remove existing platform tiles	1,306	LF	12	15,672
27	Sawcut existing topping concrete at perimeter of removal area	1,306	LF	5	6,530
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,836	SF	8	62,688
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,306	SF	15	19,590

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

7-Jan-19

STATION : QUEENSBORO PLAZA

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	69	LF	90	6,210
39	CMU Wall for equipment room	690	SF	45	31,050
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	203	SF	30	6,075
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	690	SF	40	27,600
45	Mosaic Band to match existing - Assuming 8" high	69	LF	120	8,280
46	Concrete cove to match existing	69	LF	20	1,380
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	203	SF	15	3,038
49	Allow for 4" thick concrete pads for equipment	51	SF	20	1,013
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,592	SF	750	1,944,000
61	Spare Parts - Approx. 10% of Material Cost	1	LS	243,300	243,300
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,500,000	1,500,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

7-Jan-19

STATION : QUEENSBORO PLAZA

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,306	LF	60	78,360
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	500	LF	60	30,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	550	LF	60	33,000
76	No allowance for new lighting as if APG's are used		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	Remove, store and reinstall existing signal light	1	EA	5,000	5,000
85	FA System				
86	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
87	CCTV coverage				
88	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
89	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
90	Berthing Technology Sensors				
91	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
92	Train Door Detection System				
93	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
94	Entrapment concerns				
95	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
96	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
97	Engineering and Testing	1,000	Hrs	160	159,930
98	Centralized monitoring/control				
99	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
100	MISC				
101	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
102	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

7-Jan-19

STATION : QUEENSBORO PLAZA

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
103	Site Survey and Inspections	1	LS	100,000	100,000
104	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
105	Furnish Test Equipment allowance	1	LS	500,000	500,000
106	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
107					
108	**Training**				
109	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
110					
111	**Out of hours Work**				
112	Allow loss of production to work at night say 50%	1	LS	4,043,683	4,043,683
113					
114	TOTAL PSD WORK:				$ 17,522,627

116					
117	ADD ALTERNATIVE				
118					
119	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
120					
121	ADD				
122	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	N/A	EA	25,000	-
123	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	N/A	EA	15,000	-
124	Double egress/service gate in the center of the platform; #1 per Platform	N/A	EA	30,000	-
125	Platform End Gates (PEGs)	N/A	EA	18,000	-
126	Fixed Panels including framing and support; Assuming 8'-0" high	N/A	SF	750	-
127	Spare Parts - Approx. 10% of Material Cost	N/A	LS	-	-
128	Structual framing / bracing				
129	HSS4x4x1/2 hanger	N/A	TONS	17,500	-
130	L6x6x1/2 continuous angle	N/A	TONS	17,500	-
131	Drilling and bolting - 4 bolts at each connection	N/A	EA	216	-
132	Platform Edge Repair				
133	Remove concrete platform edge				Previously done
134	Platform edge repair				Previously done
135	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
136	Signal Work [Each 300' length is associated with one signal light]				
137	Disconnects	N/A	HRS	162	-
138	Remove signal cables	N/A	LF	40	-
139	Remove conduit; Assuming 1"	N/A	LF	55	-
140	Install conduit in new position	N/A	LF	110	-
141	Install replacement cable; assumed single cable #12	N/A	LF	125	-
142	Re-commission / testing as required	N/A	EA	12,500	-
143	Engineering / Shop Drawings / Etc.	N/A	EA	7,500	-
144	Premium Time	N/A	HRS	49	-

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

7-Jan-19

STATION : QUEENSBORO PLAZA

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145					
146	OMIT				
147	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	N/A	EA	15,000	-
148	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	N/A	EA	10,500	-
149	Double egress/service gate in the center of the platform; #1 per Platform	N/A	EA	20,000	-
150	Platform End Gates (PEGs)	N/A	EA	13,000	-
151	Fixed Panels including framing and support; 4'-6" High	N/A	SF	750	-
152	Spare Parts - Approx. 10% of Material Cost	N/A	LS	243,300	-
153	Platform Edge Reconstruction work	N/A	LS	531,360	-
154	Remove allowance for cast in sleeves for LV & HV power	N/A	EA	110	-
155	Conduit running under Platform Edge	N/A	LF	30	-
156					
157	Allow loss of production to work at night say 50%	N/A	LS	-	-
158					
159	**PREMIUM ASSOCIATED WITH PSD's**				$ -

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

7-Jan-19

STATION : 5TH AVE./59TH ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [MANHATTAN BOUND] =	615	LF		
5	LENGTH OF THE PLATFORM EDGE [ASTORIA BOUND] =	615	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,230**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	AUTOMATIC PLATFORM GATES [APG's]				
10					
11	Platform edge reconstruction				
12	Demolition				
13	Remove existing polyethylene edge strip	1,230	LF	7	8,610
14	Remove 5' wide section of 3" deep structural slab to platform edge	6,150	SF	12	73,800
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	124	CY	2,500	310,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,232	EA	25	30,800
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,232	EA	25	30,800
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,230	LF	95	116,850
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	Platform edge finishes				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,230	LF	15	18,450
26	Remove existing platform tiles	1,230	LF	12	14,760
27	Sawcut existing topping concrete at perimeter of removal area	1,230	LF	5	6,150
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	7,380	SF	8	59,040
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 11'-6" wide strip	480	SF	8	3,840
30	New Work				
31	New concrete topping to match existing	1,230	SF	15	18,450

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

7-Jan-19

STATION : 5TH AVE./59TH ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	480	SF	15	7,200
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room A [7'-6" x 27'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,780
39	CMU Wall for equipment room	420	SF	45	18,900
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	203	SF	30	6,075
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	420	SF	40	16,800
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	5,040
46	Concrete cove to match existing	42	LF	20	840
47	Interior Wall Finish - Paint	420	SF	5	2,100
48	Allow for Misc. floor & ceiling finishes	203	SF	15	3,038
49	Allow for 4" thick concrete pads for equipment	51	SF	20	1,013
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	2,250	SF	750	1,687,500
61	Spare Parts - Approx. 10% of Material Cost	1	LS	227,910	227,910
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	80	EA	2,500	200,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

7-Jan-19

STATION : 5TH AVE./59TH ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	1,230	LF	60	73,800
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	700	LF	60	42,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	750	LF	60	45,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

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MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

7-Jan-19

STATION : 5TH AVE./59TH ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	3,811,576	3,811,576
113	TOTAL PSD WORK:				$ 16,516,828

115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	4,974	SF	750	3,730,365
126	Spare Parts - Approx. 10% of Material Cost	1	LS	421,942	421,942
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	5	TONS	17,500	81,657
129	L6x6x1/2 continuous angle	9	TONS	17,500	158,424
130	Drilling and bolting - 4 bolts at each connection	408	EA	216	88,128
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects	120	HRS	162	19,440
137	Remove signal cables	900	LF	40	36,000
138	Remove conduit; Assuming 1"	900	LF	55	49,500
139	Install conduit in new position	900	LF	110	99,000
140	Install replacement cable; assumed single cable #12	900	LF	125	112,500
141	Re-commission / testing as required	3	EA	12,500	37,500
142	Engineering / Shop Drawings / Etc.	3	EA	7,500	22,500
143	Premium Time	2,353	HRS	49	114,356

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

7-Jan-19

STATION : 5TH AVE./59TH ST.

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(2,250)	SF	750	(1,687,500)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	227,910	(227,910)
152	Platform Edge Reconstruction work	(1)	LS	560,600	(560,600)
153	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
154	Conduit running under Platform Edge	(1,230)	LF	30	(36,900)
155					
156	Allow loss of production to work at night say 50%	1	LS	1,083,997	1,083,997
157					
158	**PREMIUM ASSOCIATED WITH PSD's**				**4,697,318**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

7-Jan-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE [SOUTH BOUND] =	703	LF		
5	LENGTH OF THE PLATFORM EDGE [NORTH BOUND] =	703	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**1,406**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**10**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	1,406	LF	7	9,842
14	Remove 5' wide section of 3" deep structural slab to platform edge	7,030	SF	12	84,360
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	142	CY	2,500	355,000
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	1,408	EA	25	35,200
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	1,408	EA	25	35,200
19	Cast in assemblies for PSD holding down bolts	640	EA	180	115,200
20	Polyethylene edge strip	1,406	LF	95	133,570
21	Provide sleeves for HV & LV wires	328	EA	110	36,080
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	1,406	LF	15	21,090
26	Remove existing platform tiles	1,406	LF	12	16,872
27	Sawcut existing topping concrete at perimeter of removal area	1,406	LF	5	7,030
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	8,436	SF	8	67,488
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 10' wide strip	320	SF	8	2,560
30	New Work				
31	New concrete topping to match existing	1,406	SF	15	21,090

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

7-Jan-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	320	SF	15	4,800
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	480	LF	110	52,800
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room#1 [7'-6" x 17'-0"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	32	LF	90	2,880
39	CMU Wall for equipment room	320	SF	45	14,400
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	128	SF	30	3,825
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	320	SF	40	12,800
45	Mosaic Band to match existing - Assuming 8" high	32	LF	120	3,840
46	Concrete cove to match existing	32	LF	20	640
47	Interior Wall Finish - Paint	320	SF	5	1,600
48	Allow for Misc. floor & ceiling finishes	128	SF	15	1,913
49	Allow for 4" thick concrete pads for equipment	32	SF	20	638
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Equipment Room#2 [7'-6" x 17'-0"]**				
56	Build off existing platform slab		Note		
57	Form 8" wide concrete curb including dowelling to platform slab	32	LF	90	2,880
58	CMU Wall for equipment room	320	SF	45	14,400
59	Vertical connections with existing structure	20	LF	25	500
60	Roof for equipment room	128	SF	30	3,825
61	Fire rated door including frame & hardware	1	EA	2,500	2,500
62	Exterior wall finish				
63	Ceramic Tiling to match existing	320	SF	40	12,800
64	Mosaic Band to match existing - Assuming 8" high	32	LF	120	3,840
65	Concrete cove to match existing	32	LF	20	640
66	Interior Wall Finish - Paint	320	SF	5	1,600
67	Allow for Misc. floor & ceiling finishes	128	SF	15	1,913
68	Allow for 4" thick concrete pads for equipment	32	SF	20	638
69	Allowance for Mechanical Scope	1	LS	40,000	40,000
70	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
71	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
72	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

7-Jan-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
73					
74	**Automatic Platform Gates [APGs] - 4'-6" High**				
75	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	80	EA	15,000	1,200,000
76	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	10,500	819,000
77	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
78	Platform End Gates (PEGs)	4	EA	13,000	52,000
79	Fixed Panels including framing and support; 4'-6" High	3,042	SF	750	2,281,500
80	Spare Parts - Approx. 10% of Material Cost	1	LS	263,550	263,550
81	Testing and commissioning	800	HRS	160	127,944
82	Product Warranty	1	LS	1,000,000	1,000,000
83	Allowance for Braille Signage	80	EA	2,500	200,000
84					
85	**Electrical**				
86	Electrical Upgrades				
87	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
88	Power and Lighting				
89	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
90	Allow for conduit / cable runs for power and communications under platform edge	1,406	LF	60	84,360
91	PSD Connections	1	LS	75,000	75,000
92	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
93	Power to PSD Rooms from EDR [Conduit & Cable]	350	LF	60	21,000
94	Reserve power to PSD Room from EDR [Conduit & Cable]	400	LF	60	24,000
95	No allowance for new lighting as if APG's are used		Note		EXCL.
96	Grounding				
97	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
98	MISC				
99	Testing and commissioning	1	EA	30,000	30,000
100	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
101					
102	**Communications**				
103	FA System				
104	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
105	CCTV coverage				
106	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	100	EA	12,000	1,200,000
107	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
108	Berthing Technology Sensors				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

7-Jan-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
109	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	10	EA	16,000	160,000
110	Train Door Detection System				
111	Train Door Detection Sensor including software and hardware requirements	10	EA	15,000	150,000
112	Entrapment concerns				
113	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	240	EA	4,629	1,111,018
114	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	240	EA	5,566	1,335,735
115	Engineering and Testing	1,000	Hrs	160	159,930
116	Centralized monitoring/control				
117	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
118	MISC				
119	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
120	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
121	Site Survey and Inspections	1	LS	100,000	100,000
122	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
123	Furnish Test Equipment allowance	1	LS	500,000	500,000
124	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
125					
126	Training				
127	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
128					
129	Out of hours Work				
130	Allow loss of production to work at night say 50%	1	LS	4,093,287	4,093,287
131					
132	TOTAL PSD WORK:				$ 17,737,576

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
134					
135	ADD ALTERNATIVE				
136					
137	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
138					
139	ADD				
140	Automatic bi-parting doors (10 Cars x 4 Doors =40 No. per platform)	80	EA	25,000	2,000,000
141	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	78	EA	15,000	1,170,000
142	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000

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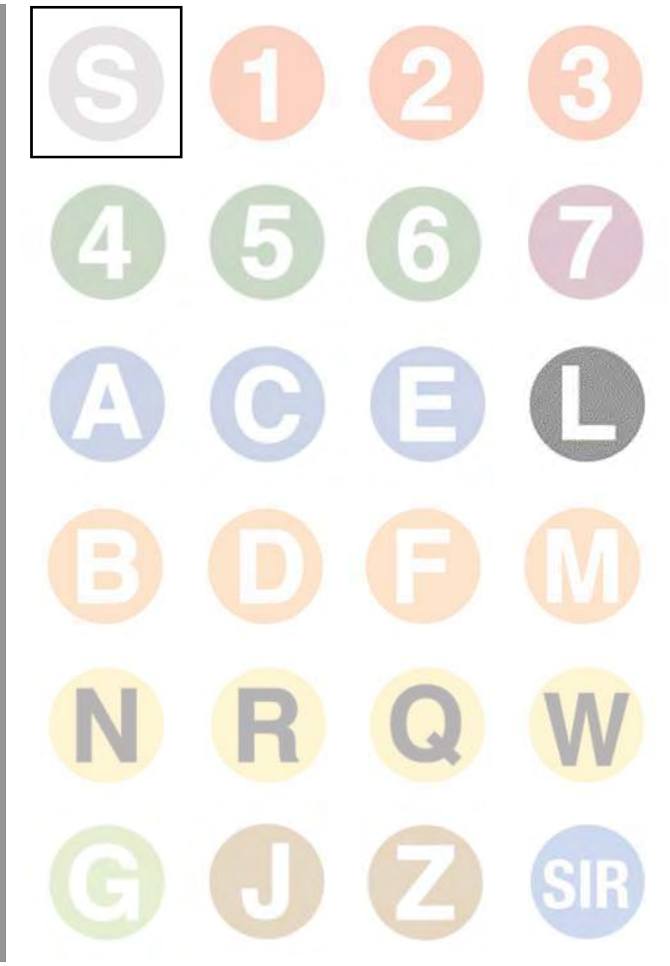
Tier 2-3 Report on Feasibility of Platform Edge Barriers for W - Line Stations

7-Jan-19

STATION : 49TH STREET

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
143	Platform End Gates (PEGs)	4	EA	18,000	72,000
144	Fixed Panels including framing and support; Assuming 8'-0" high	6,382	SF	750	4,786,365
145	Spare Parts - Approx. 10% of Material Cost	1	LS	485,302	485,302
146	Structual framing / bracing				
147	HSS4x4x1/2 hanger	5	TONS	17,500	93,155
148	L6x6x1/2 continuous angle	10	TONS	17,500	181,093
149	Drilling and bolting - 4 bolts at each connection	562	EA	216	121,478
150	Platform Edge Repair				
151	Remove concrete platform edge				Previously done
152	Platform edge repair				Previously done
153	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
154	Signal Work [Each 300' length is associated with one signal light]				
155	Disconnects	120	HRS	162	19,440
156	Remove signal cables	900	LF	40	36,000
157	Remove conduit; Assuming 1"	900	LF	55	49,500
158	Install conduit in new position	900	LF	110	99,000
159	Install replacement cable; assumed single cable #12	900	LF	125	112,500
160	Re-commission / testing as required	3	EA	12,500	37,500
161	Engineering / Shop Drawings / Etc.	3	EA	7,500	22,500
162	Premium Time	2,353	HRS	49	114,356
163					
164	OMIT				
165	Automatic bi-parting gates; Assumed 6'-0" wide (10 Cars x 4 Doors = 40 No. per platform)	(80)	EA	15,000	(1,200,000)
166	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #39 per Platform	(78)	EA	10,500	(819,000)
167	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
168	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
169	Fixed Panels including framing and support; 4'-6" High	(3,042)	SF	750	(2,281,500)
170	Spare Parts - Approx. 10% of Material Cost	(1)	LS	263,550	(263,550)
171	Platform Edge Reconstruction work	(1)	LS	624,960	(624,960)
172	Remove allowance for cast in sleeves for LV & HV power	(328)	EA	110	(36,080)
173	Conduit running under Platform Edge	(1,406)	LF	30	(42,180)
175	Allow loss of production to work at night say 50%	1	LS	1,230,276	1,230,276
176					
177					
178	**PREMIUM ASSOCIATED WITH PSD's**				$ 5,331,194

New York City Transit



REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR 'S' LINE STATIONS IN MANHATTAN

April 30, 2018

STV 100 Years

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Report on Feasibility of Platform Edge Barriers at 42nd Street Shuttle Stations (MR-468 and MR-469)

Introduction: In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility study which done to identify a location for a pilot installation of half height Platform Screen Doors (PSD) at a revenue station. That study was published in August 2017. A summary of the technology section of that report (section 1.0 through 5.0) is included in Appendix A of this report for reference. It generically analyzes issues of platform edge technology, operations issues, and code in regard to the installation of platform edge barriers across the NYCT system. Section 6 of that report looked at the impact of this new technology on four stations on the Canarsie line in Manhattan. This report continues the station analysis with section 1.0 pertaining to the two platforms, Times Square Station and Grand Central Station, serving each end of the 42nd Street Shuttle Line.

In the hierarchy of our system-wide study, this is a Tier 2/3 report. The Tier 1 analysis of door arrangement in the vehicles dedicated to this line found that there are no problems of incompatibility; One train car type and one train consist will be run in the future 2-track, 6-car train scenario on the Times Square / Grand Central Shuttle. Our analysis is based upon design drawings for contract A-35301 / 37116 for the reconfiguration of the Shuttle platforms (a summary extract from those drawings is included as an Appendix to this report). Those design drawings show two 6-car trains platforming on each side of a center platform at each end of the Shuttle. The train cars and consists are shown generically with no distinction between A or B cars. Based upon the car assignment update from Operations Planning (Nov 2017) we have used the R62A cars for the supporting diagrams in this study.

Following the methodology of our system-wide analysis, this Tier 2/3 report looks at issues of obstructions near the platform edge, platform edge curvature, structural feasibility, location of the equipment room, and an evaluation of available power.

Computational Fluid Dynamics (CFD) analysis is beyond the scope of this study due to the time and cost involved. Based upon CFD analyses done for the 3rd Avenue pilot installation of half height automated platform gates (APGs) this study assumes that such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.

An NFPA130 timed egress analysis for the existing stations or for potential APG/PSD designs is also beyond the scope of this study.

1.0 Station Descriptions

1.1 Grand Central Station – 'S' Shuttle Platforms

Executive Summary: *Grand Central Station is not feasible for APGs or PSDs due to the close proximity of columns to the platform edge (16") at the western end of the north platform. Contributing to this finding are other constraints including a low girder in the same area that would conflict with full height PSDs and existing stair P8 on the south platform that limits space available for APG/PSDs.*

The existing Shuttle platforms at Grand Central Station (GCS) are made up of two end-loaded platforms serving three dead ended tracks running three, four-car trains. The new design for the Shuttle fills in the center track to create a new larger center platform serving two tracks running the longer six-car trains. In order to accommodate the longer train on the northern track the project will open up an area of the platform currently used as back-of-house. An illustration of the new configuration follows on page 4 (Figure 1).

Full height PSDs: As already noted in the Executive Summary above APG/PSDs are not feasible. Were that not the case, existing lighting and conduit on the station ceiling would have to be reconfigured if full height PSDs were to be installed. In addition, full height PSDs would require lateral bracing to the roof structure.

Half Height APGs: If APGs could be installed they present a slightly simpler installation scenario. Ceiling mounted lighting would have to be reconfigured to accommodate APG entrapment prevention sensors and CCTV cameras, no other new systems would touch the ceiling.

Equipment Room

Space appears available. However, it was not studied due to infeasibility created by obstructions at the platform edge.

Track Layout

New platform configuration based on current track alignment. Southern track is tangent and the northern track is tangent with a slight curve at the west end. No excessive gaps are anticipated.

Platform edge condition

Existing conditions: Porcelain tactile tiles laid on recently rebuilt concrete cantilever. See the draft report on Structural Feasibility of Platform Barriers (Appendix B). There are currently no plans to rebuild the GCS Shuttle platform edges under contract A-35301/37116. Based upon the structural report, installation of the half-height APGs would require reconstruction of the platform edges. However, the full-height PSDs could be installed utilizing the existing concrete platform were it not for other constraints.

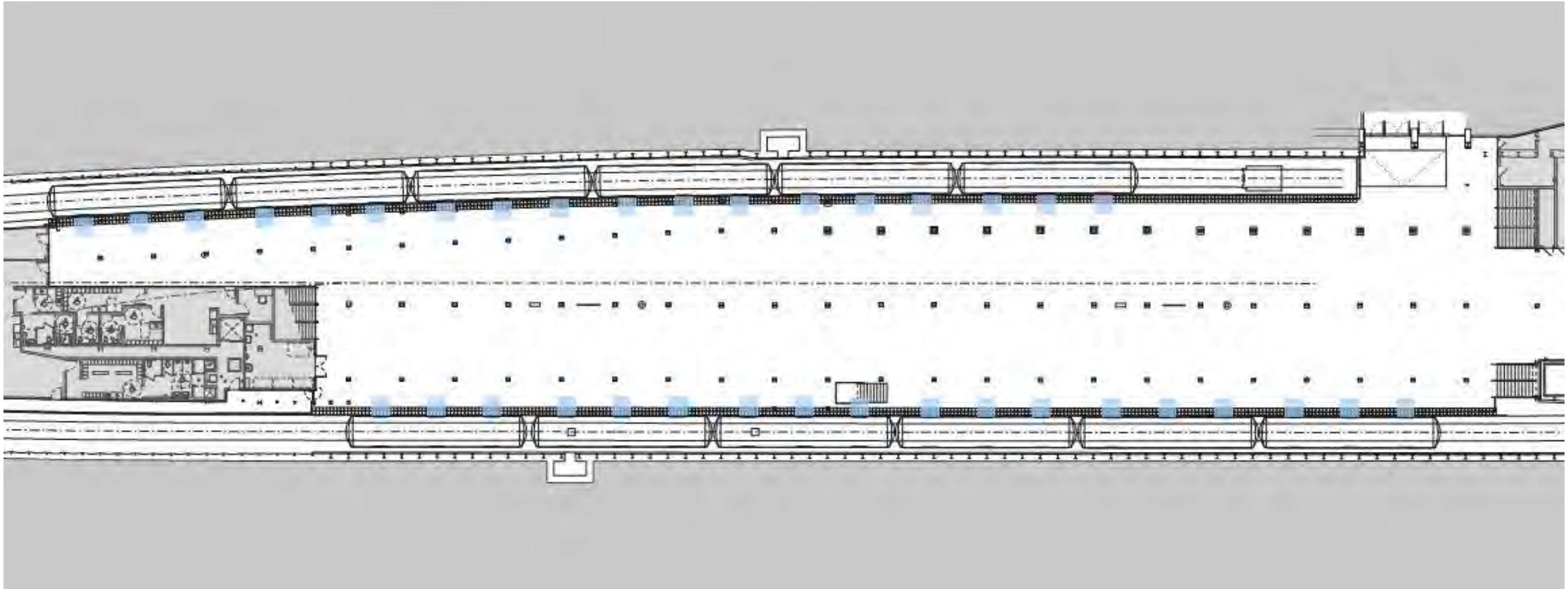


Figure 1 - Plan – Grand Central Station Shuttle overall plan (north is to the top of the plan)

Platform obstructions within 5' of edge:

Since there is some curvature at the west end of the north track in this station and because the Time Square platform at the other end of the shuttle is curved at the west end, the ADA boarding area will be located at the east end of each platform where the track is tangent. In these areas there are no obstructions within 5 feet of the platform edge.

At the western end of the North platform the existing columns are 16 inches from the platform edge. That creates a conflict at the platform edge that make half height APGs and full height PSDs impossible. Above these columns there is an existing low girder that would make installation of full height PSDs even more difficult without reframing the existing roof structure.

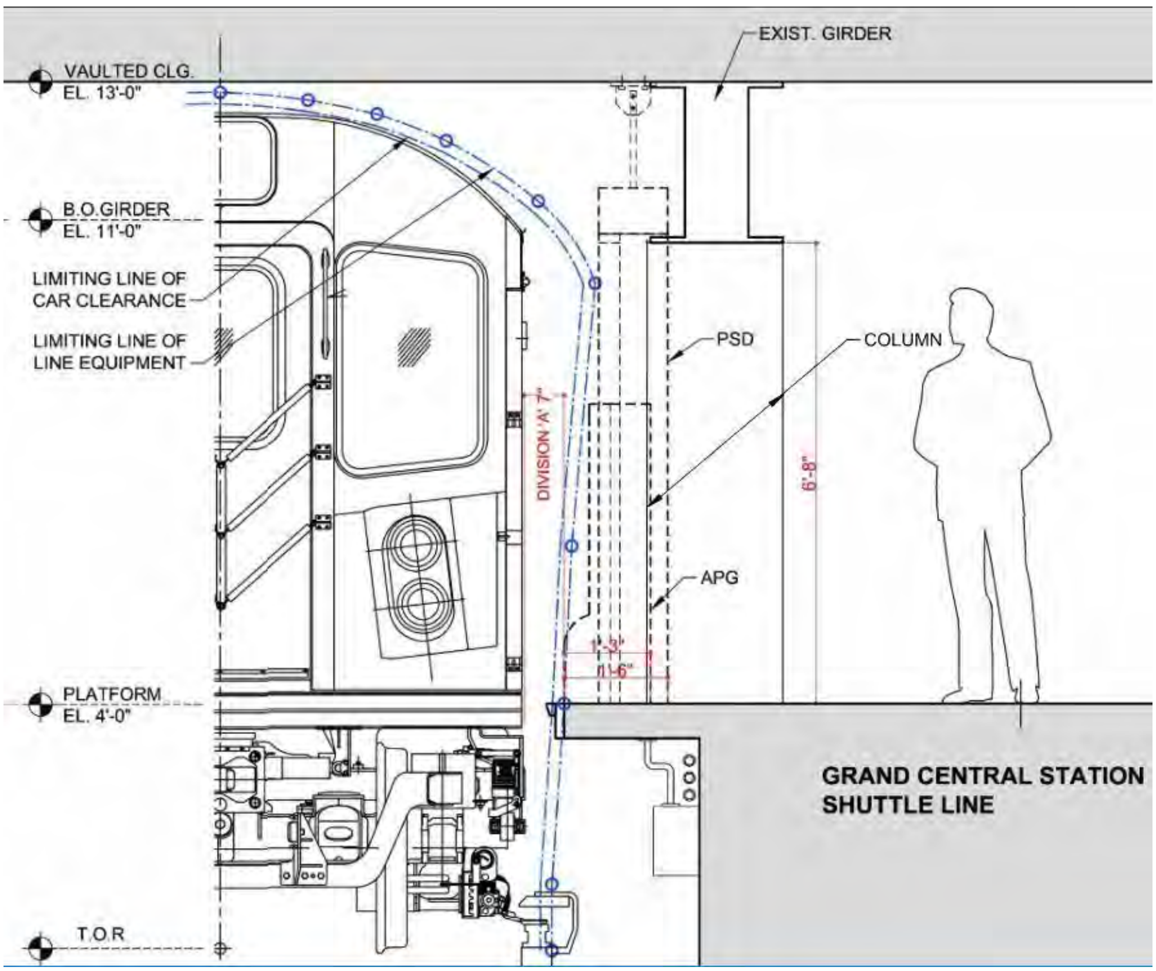


Figure 2 - Grand Central Station – Cross Section at west end of north platform showing conflict with column and beam

Figure 3 - Grand Central Station Shuttle – West end of north platform showing limited clearance for APGs or PSDs

On the South platform edge existing stair (P8) reduces space at the platform edge such that a 60" circle (ADA clearance for wheel chair turn around) does not fit. See Figure 4 below.

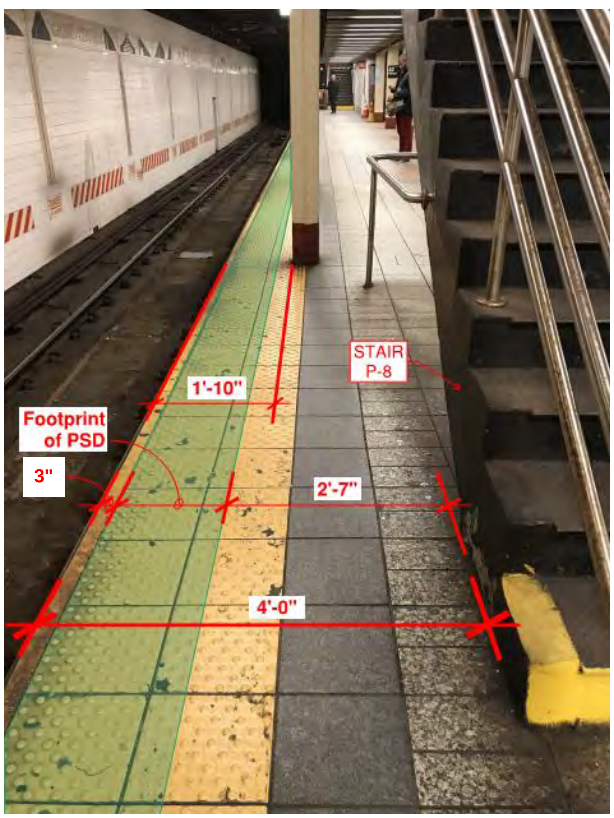


Figure 4 – Grand Central Station Shuttle – South platform detail of existing boarding clearances at Stair P8; ADA wheel chair turnaround of 60 inches does not fit

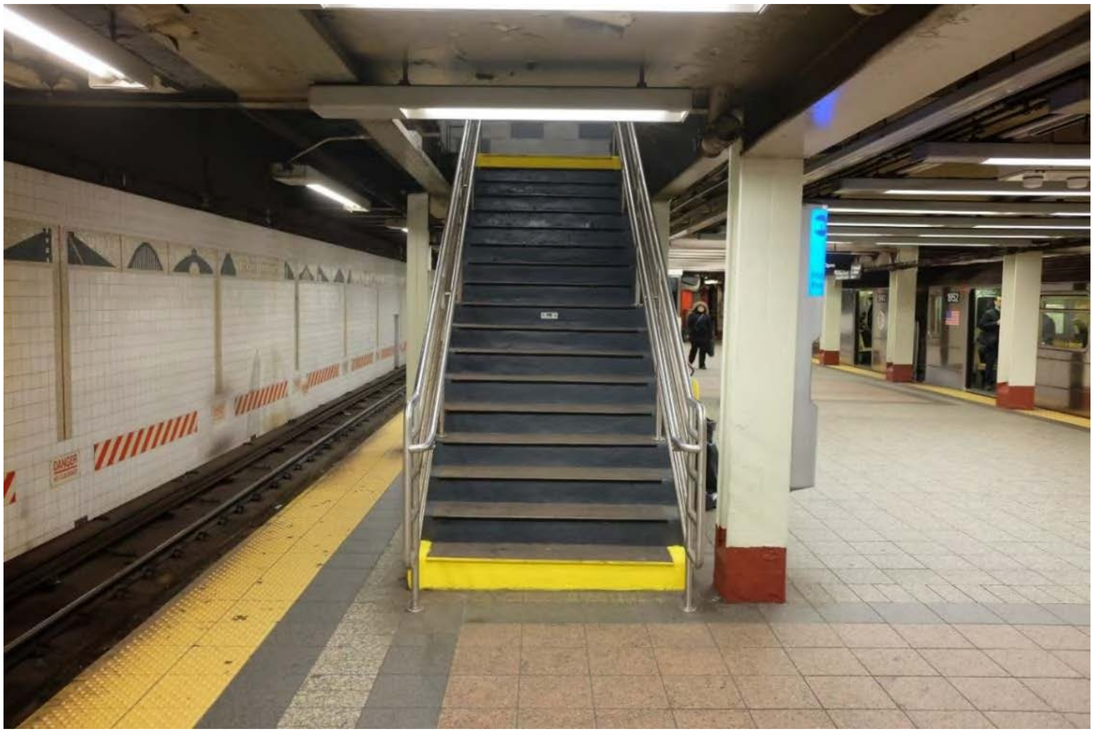


Figure 5 – Grand Central Station Shuttle – South platform photo Stair P-8

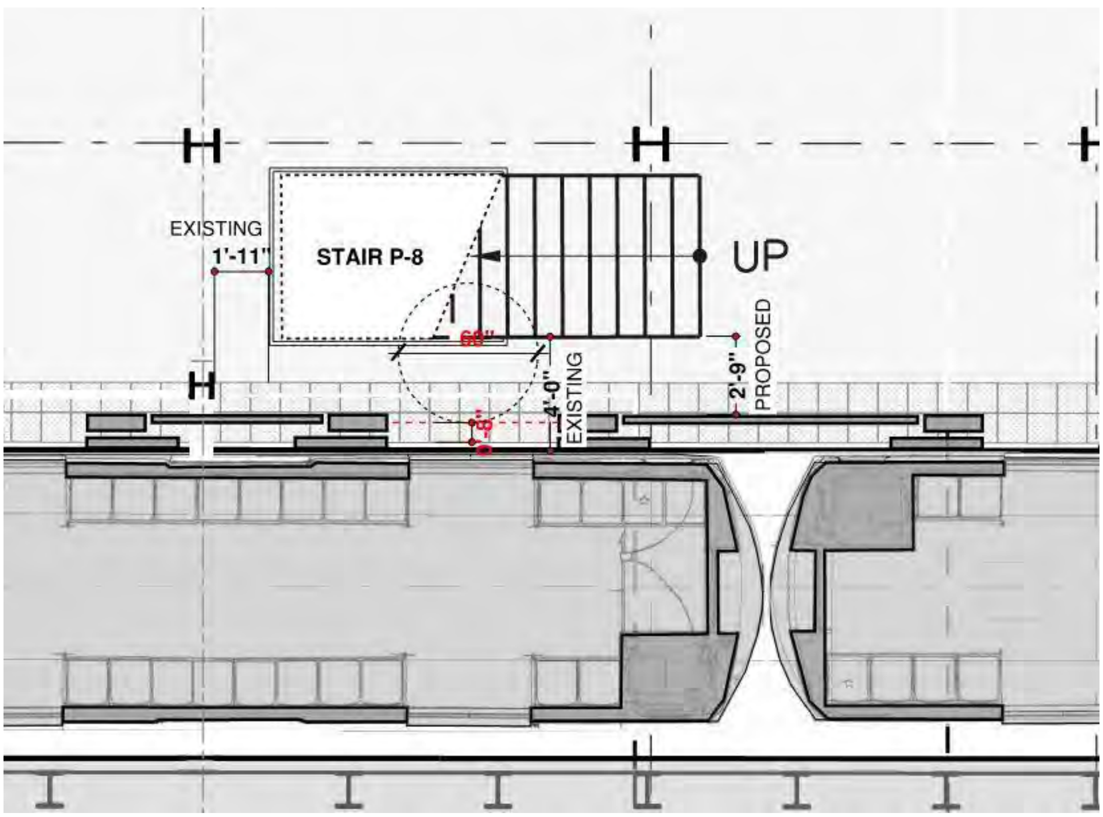


Figure 6 – Grand Central Station Shuttle – South platform plan view of existing boarding clearances at Stair P8; 60 inch circle is shown (ADA wheelchair turnaround)

Lighting:
Existing lighting: Linear fluorescent; approximately 12" from platform edge. Would not be an issue if APGs could be installed. Would require reconfiguration if PSDs were possible.

Power:
Power is adequate for either APGs or PSDs. (See Section 1.2 – Power, page 11 of this report)

Historic Restrictions:
The Shuttle at Grand Central is adjacent to historically designated property at the railroad terminal.

Rough order-of-magnitude cost estimate:
No estimate was performed due to infeasibility at this station.

1.2 Times Square Station – 'S' Shuttle Platforms

Executive Summary: *Times Square Station has been determined to be feasible for APGs or PSDs. This report enumerates relevant feasibility criteria with a brief narrative and a rough order-of-magnitude cost estimate for the installation of APG/PSDs with certain qualifications. The ROM cost is estimated to be $17,291,403 in current dollars.*

The existing Shuttle platforms at Times Square Station are made up of three curved platforms serving three tracks and three, three-car trains. The new design for the Shuttle (contract A-35301 / 37116) fills in the center track, creates a new end loaded, island platform and moves trains further east to minimize the curved platform edges. The new larger center platform will serve two tracks running two longer six-car trains. See Figure 8 on the next page.

Full height PSDs: After the construction of Contract A35302 / A37116 there are a number of modifications that would be required to accommodate PSDs. Since the Contract A35302 / A37116 drawings do not represent an as-built condition, one can assume lighting on the station ceiling (whether existing lighting with conduit, wiring trough or Enhanced Station Initiative (ESI) - type integrated systems) would have to be reconfigured to accommodate full height PSDs. Ideally the PSD header beam could incorporate the required gap entrapment sensors, CCTV cameras, and lighting to replace what is on the ceiling. Alternatively the lighting, entrapment prevention sensors, and CCTV cameras would have to be relocated on the ceiling in coordination with full height PSDs. In either scenario lateral bracing of the full height system would have to be addressed.

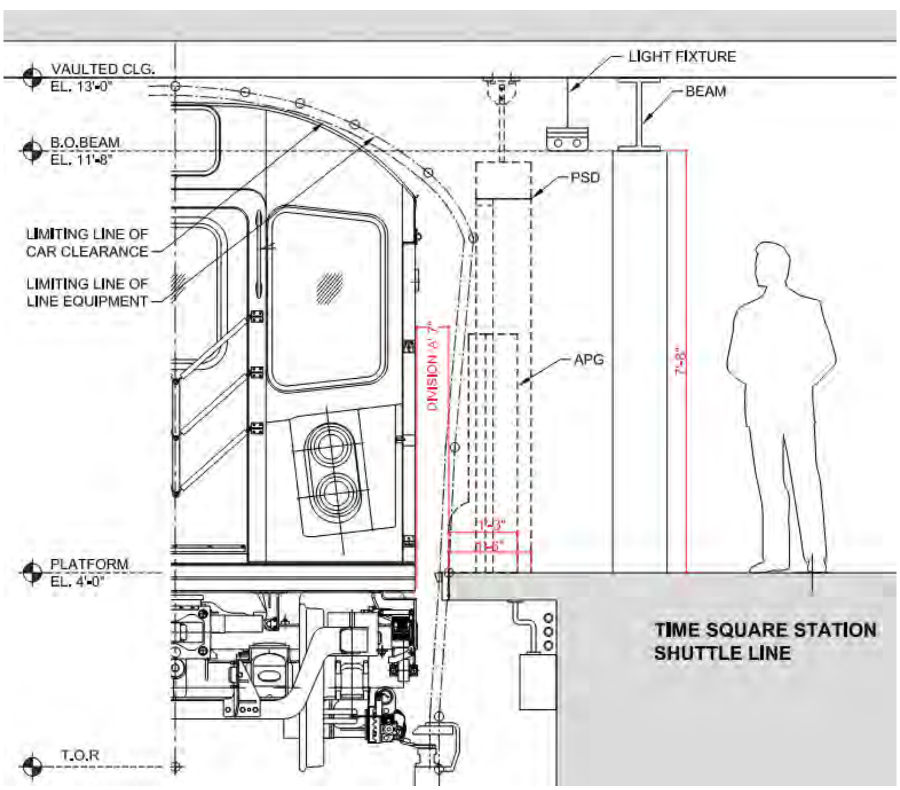


Figure 7 – Time Square Station Shuttle – Cross Section showing lighting on ceiling, clearance for full height PSDs and half height APGs

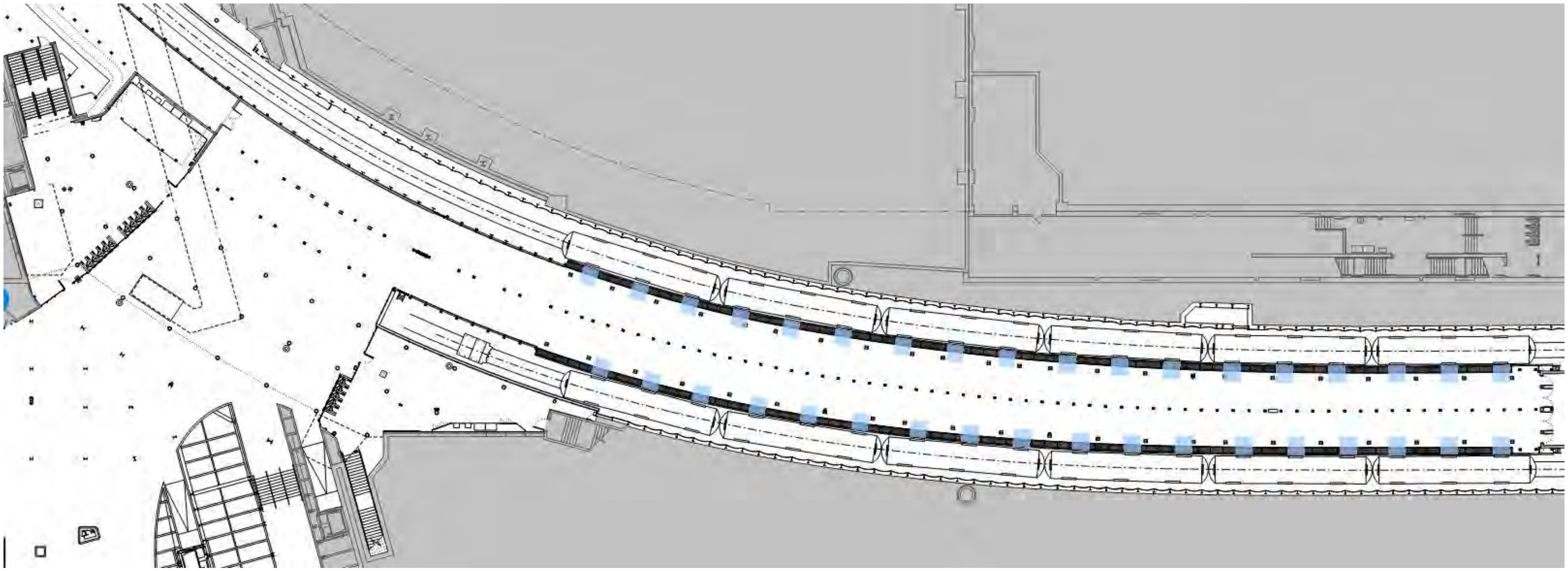


Figure 8 - Times Square Station Shuttle - Proposed future platform; north is to the top of the plan; notice tangent track at the east end of the platform

Half Height APGs: If APGs are installed they present a slightly simpler installation scenario. Ceiling mounted lighting would have to be reconfigured to accommodate APG entrapment prevention sensors and CCTV cameras, no other new systems would touch the ceiling. See Figure 7.

Equipment Room

Space required for equipment room is available at the west end of the platform in a non-public area. See Figure 9 below.

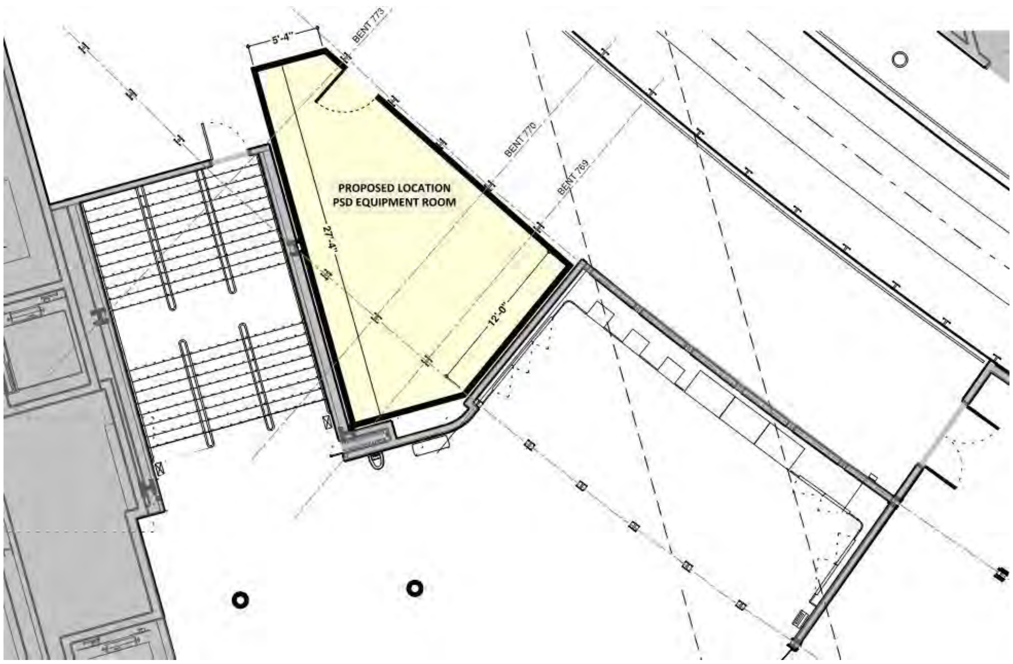


Figure 9 - Times Square Station Shuttle – space for PSD Equipment Room at east end

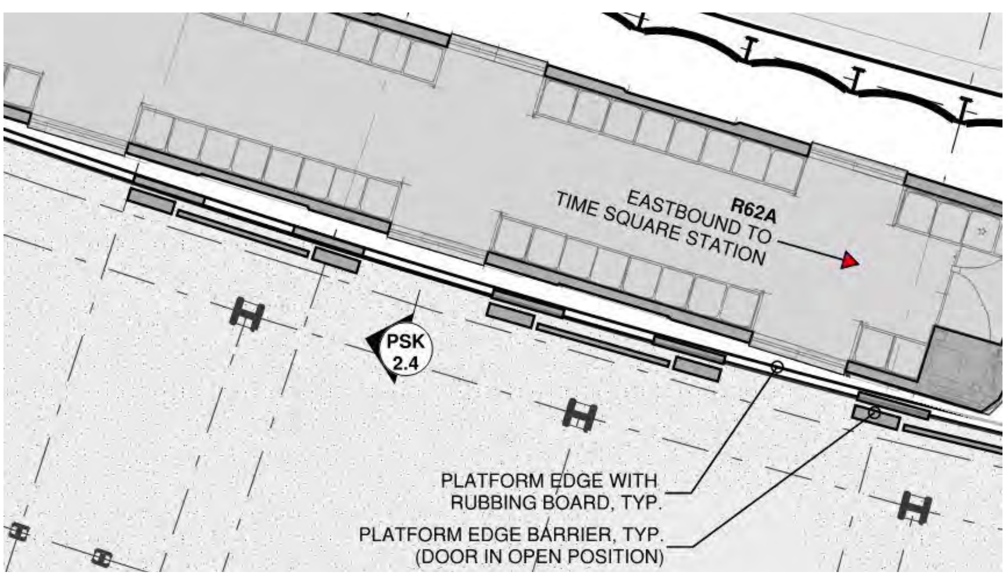


Figure 10 - Times Square Station Shuttle – curved track showing center gaps on north platform

Track Layout

Except at the extreme east end of the platform the track is curved which leads to larger gaps between the platform and the train as well as larger gaps between the train and the APG/PSD when compared to tangent track. There could be as much as five inches of center excess on the north edge, and five inches of end excess on the south platform edge. Due to these non-tangent gaps, the potential entrapment (eleven inches on tangent track) will now be approximately 16", increasing the potential for entrapment. A system of entrapment prevention sensors would developed in the design of the PSD/APG system to address this.

Platform edge condition

The new platform (Contract A-35302 / A-37116) is not designed to accommodate the structural loads of a PSD or APG system. If PAS/APGs are installed structural reconstruction of the platform edge would be required.

Platform obstructions within 5' of edge:

The design of the new columns places them 3'-8" from the platform edge. This will result in the partial obstruction of some doors but is not a fatal flaw. Since the new platform relies on existing curved track the ADA boarding area will be located at the east end of the platform corresponding to the ADA boarding area at GCS. This boarding area can remain compliant with APG/PSDs.

Lighting:

The Contract A-35302 / A-37116 documentation reviewed did not indicate the planned lighting scheme in detail except to show linear lighting near the platform edge. This future lighting, conduits, wiring trough or Enhanced Station Initiative (ESI) - type integrated systems on the station ceiling would have to be reconfigured with the full height PSDs or with CCTV and entrapment sensors for APGs.

Power:

Power is adequate based on planned reconstruction at Times Square.

See Electrical Capacity Analysis (Figure 11) on the next page based upon field observations at Times Square Station as well as Grand Central Station.

42nd Street Shuttle Line Electrical Capacity Analysis			
	Times Square, MR-468	**Grand Central, MR-469**	
	EDR (Only Normal Power)	EDR Normal	EDR Reserve
Station Peak - Peak Demand Load (Last 20 months)	72.8kW≡253A	85.6kW≡297A	
PSD - APG/PSD Load ('new' load) (Total Load for **36** doors, including all Miscellaneous Loads)	33.5kW≡116A	33.5kW≡116A	
Total Load (Station Peak + PSD)	369A	413A	
Station Service Capacity	1200A	1200A	1200A
Notes	Electrical Service is Adequate	Electrical Service is Adequate	
Based on 3 phase, 208V @ 0.8 P.F. Assumption: - 21.5 kW for 36 Doors/ Station; based on "APG" system manufacture. - 12.0 kW for Miscellaneous Loads (AC, Communication, Berthing, etc.) 6 Cars x 3 Doors x 3 Platforms			

Figure 11 - Electrical Capacity Analysis

Historic Restrictions:

The Shuttle at Times Square is a historically designated property. As such, design will require review by the New York State Historic Preservation Office.

Rough order-of-magnitude cost estimate:

Total cost for Times Square Station is estimated to be $17,291,403 in current 2018 dollars. This is based on a summary of expected costs developed through a review of conditions in the field, analysis of space constraints, length and numbers of doors (MSDs and EEDs), existing documentation and professional judgement. It is not based upon an actual conceptual design. The 'basis of estimate' assumptions are listed in the ROM estimate (Appendix, Section 2.3). The following factors have had an impact on the ROM estimate:

- Reconfiguration of existing lighting, conduits, wiring trough or ESI - type integrated systems on the station ceiling is assumed to be typical of found conditions on other low ceiling, below grade stations.

- Coordination of existing ceiling mounted systems and fixtures is likely to be marginally higher for full height PSDs.
- New platform edges at Times Square Station are not designed to accommodate the structural requirements for PSD/APG systems, the cost estimate includes the reconstruction of the platform as well as replacement of the concrete topping and finish along the platform edges to accommodate the PSD/APG installation.

End of Report

2.0 List of Appendices

2.1 Appendix A – Technology Summary

2.2 Appendix B – Structural Feasibility of Platform Barriers

2.3 Rough Order of Magnitude Cost Estimate

2.4 Contract A35302 / A37116 Drawings (Summary: plans and sections)

Table of Contents

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*
>
> a. *Column location in relation to the platform edge*
> b. *Platform edge clearance adjacent to stairs and other impediments*
> c. *Impacts to ADA path of travel and boarding areas*
> d. *Conflicts of PSD/APG/RPSDs with Signals cables*
> e. *Sufficient platform width*
> f. *Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*
>
> a. *Structural capacity of platforms to accept PSD/APG/RPSDs*
> b. *Feasibility & location for PSD/APG/RPSDs equipment room*
> c. *Confirmation of adequate power for PSD/APG/RPSDs*
> d. *Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> e. *Determination of communications requirements, availability and cost*
> f. *Determination of gap detection and entrapment avoidance technology requirements*
> g. *Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
   - Double the amount of motors as PSDs (each motor operating a single leaf).
   - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
   - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
   - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	**Comments**
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY. Status of doors will be provided to crew via indicator lights, with no automated propulsion cutout.

If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

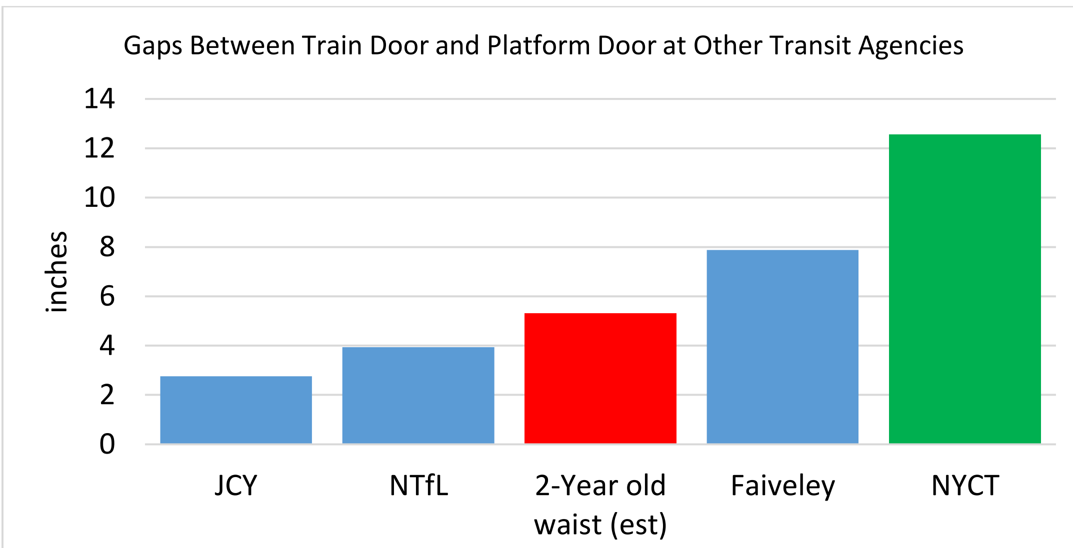


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

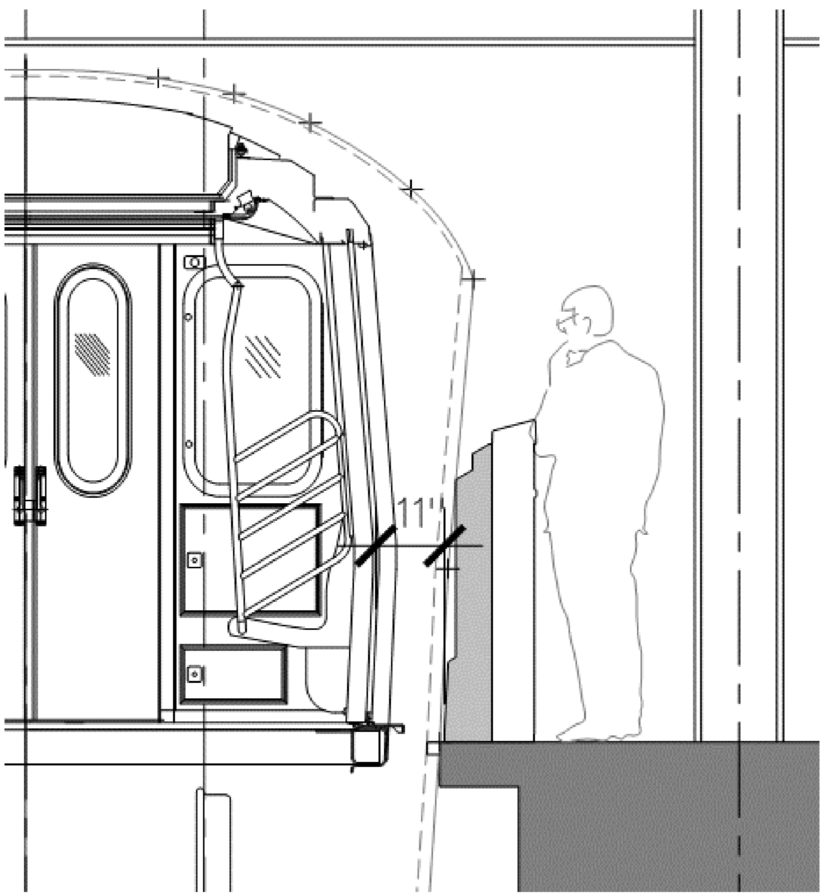


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber “bumpers” on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6” into the line equipment envelope. This would leave a 5” gap between the platform and car doors allowing approximately 2” of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5" by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor's window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor's window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **<u>bold/underline</u>**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	PSD System 1	PSD System 2	PSD System 3
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are “existing” as defined by code. All the rolling stock is also to be considered “existing” under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60” radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36” of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

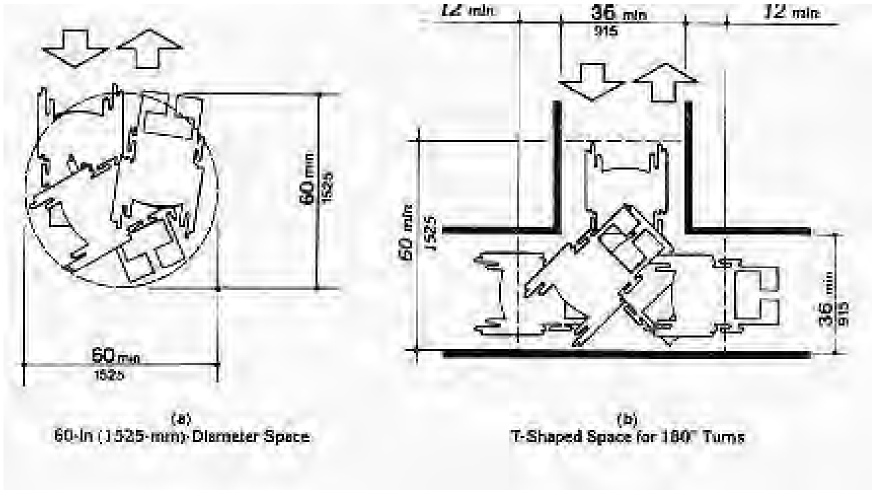
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

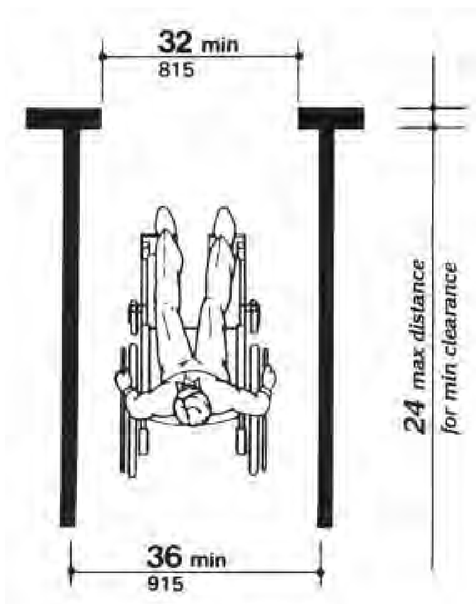


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

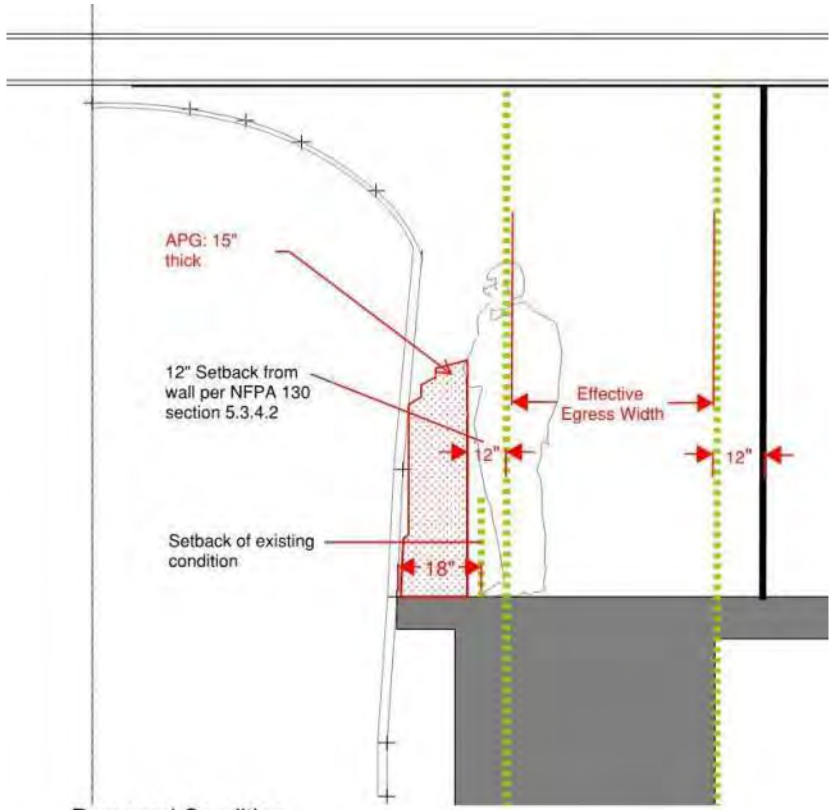
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15" of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Appendix B

New York City Transit

REPORT ON STRUCTURAL FEASIBILITY OF PLATFORM EDGE BARRIERS FOR SYSTEM-WIDE INSTALLATION

NEW YORK CITY SUBWAY SYSTEM

April 19, 2018

CONTRACT #: C-32514 | STV PROJECT #: 3017214

STV 100 Years

Table of Contents

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the United States and the world, with the intent of preventing customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4’-0”). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

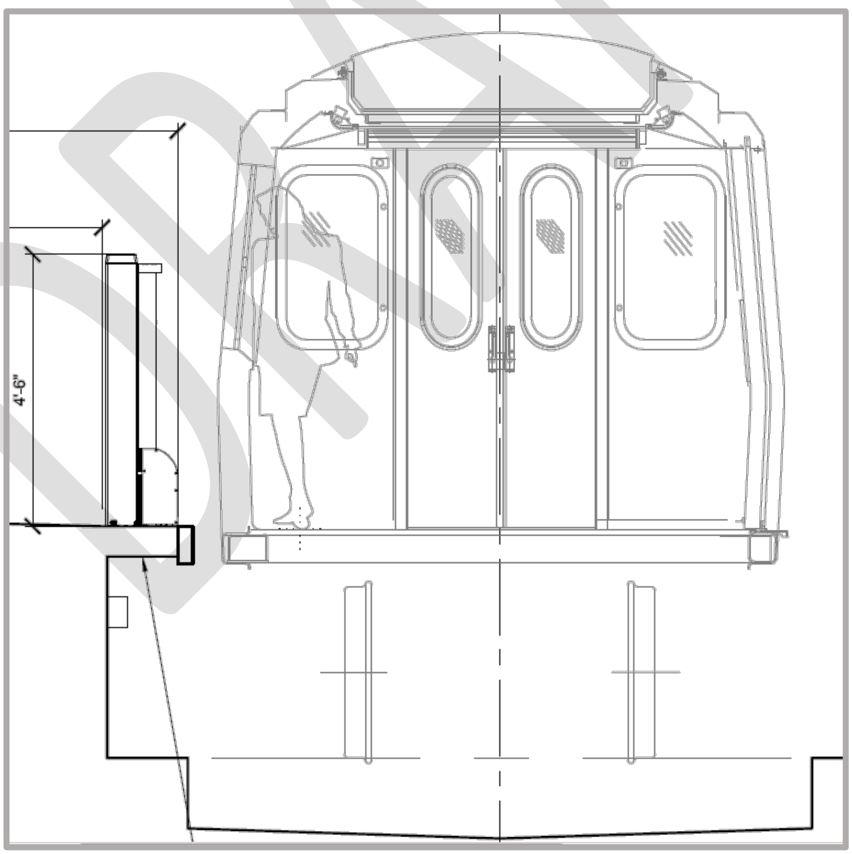


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

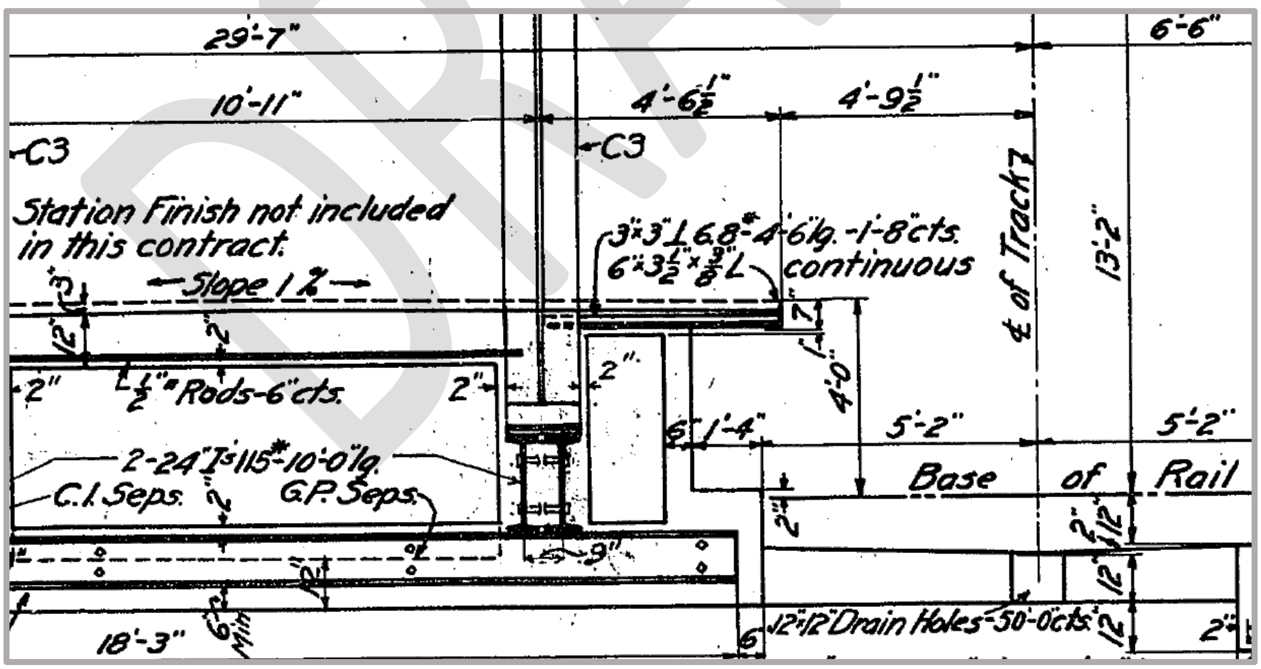


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

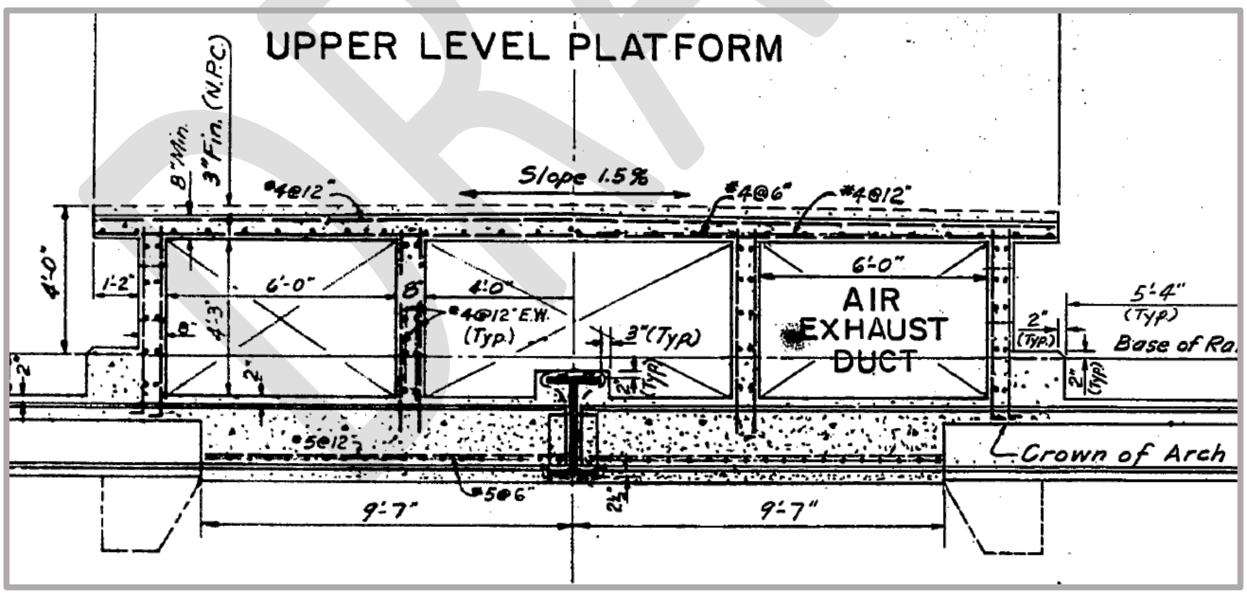


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

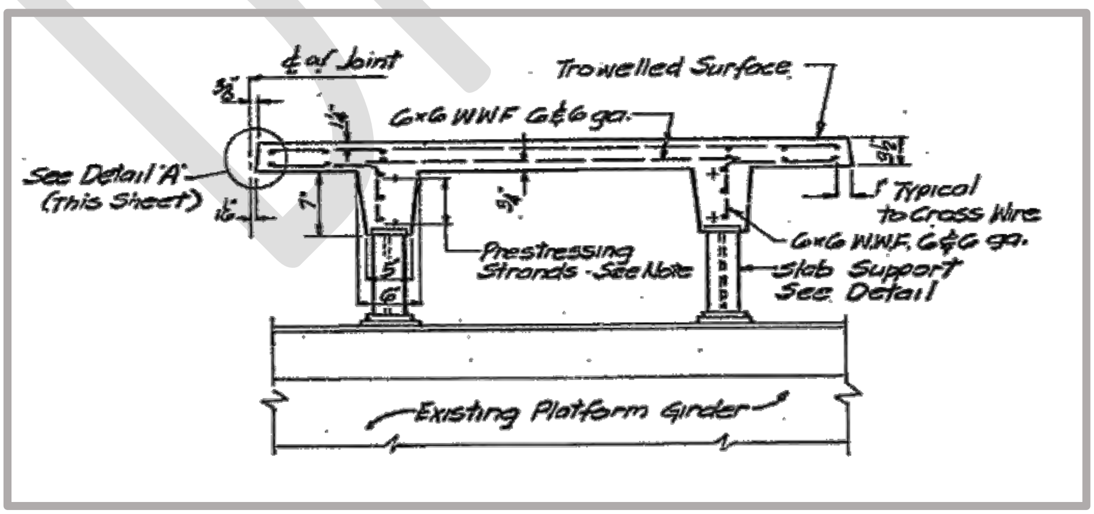


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See ***Figure 4-4*** *Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)****Figure 4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

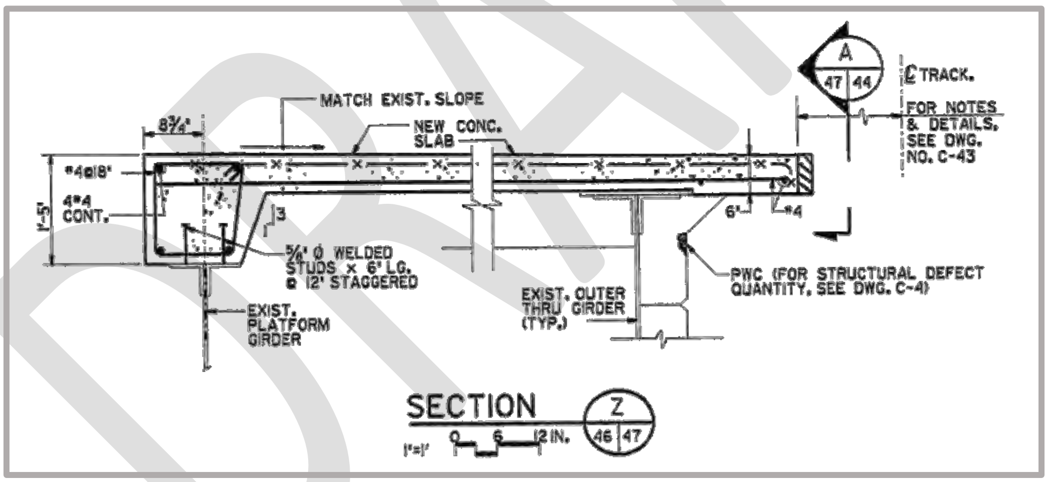


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. While the platform slab is cast-in-place concrete, it has a longer cantilever than elsewhere in the system (approximately 2'-9") and cannot support the PSD system. As a result, a portion of the platform slab would have to be rebuilt with additional reinforcing. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

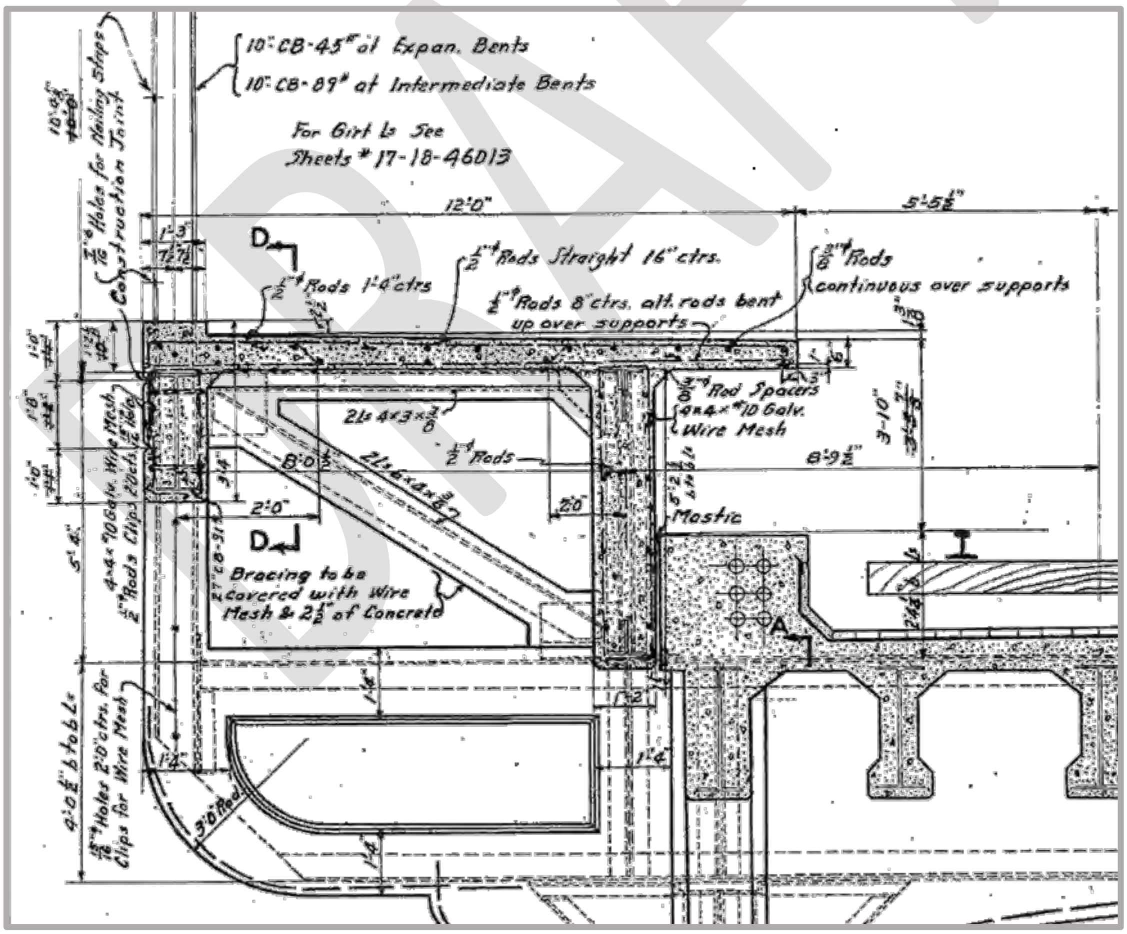


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3" thick structural slab with an approximately 3" thick topping slab. If the topping slab is fully removed, a 6" thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6" thick slab will be sufficient for a cantilever length of up to approximately 3'-0", greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6" structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6" minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

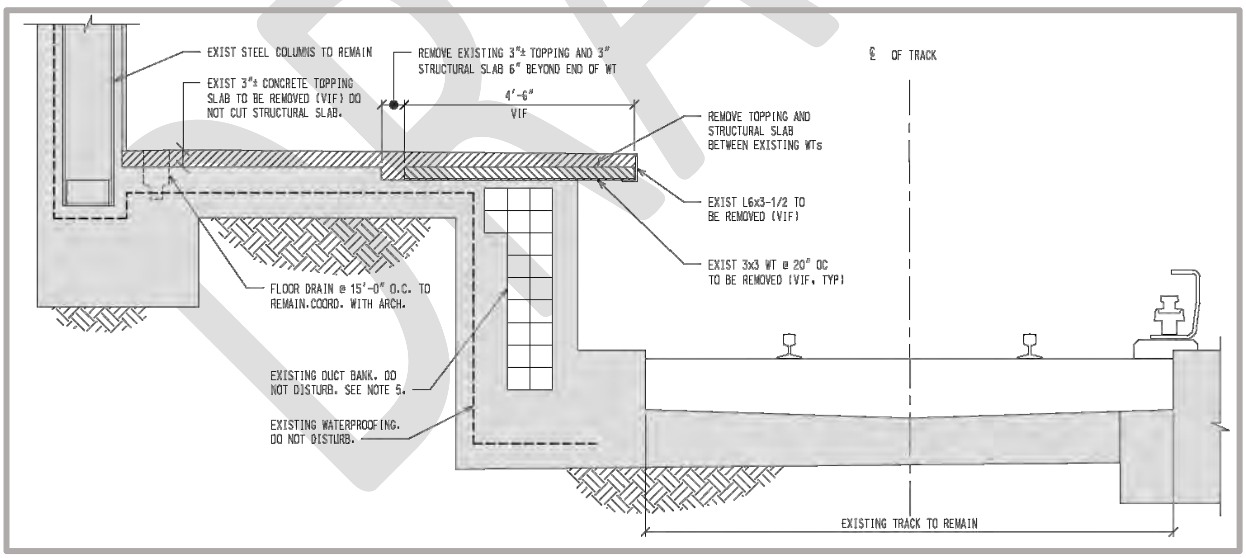


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

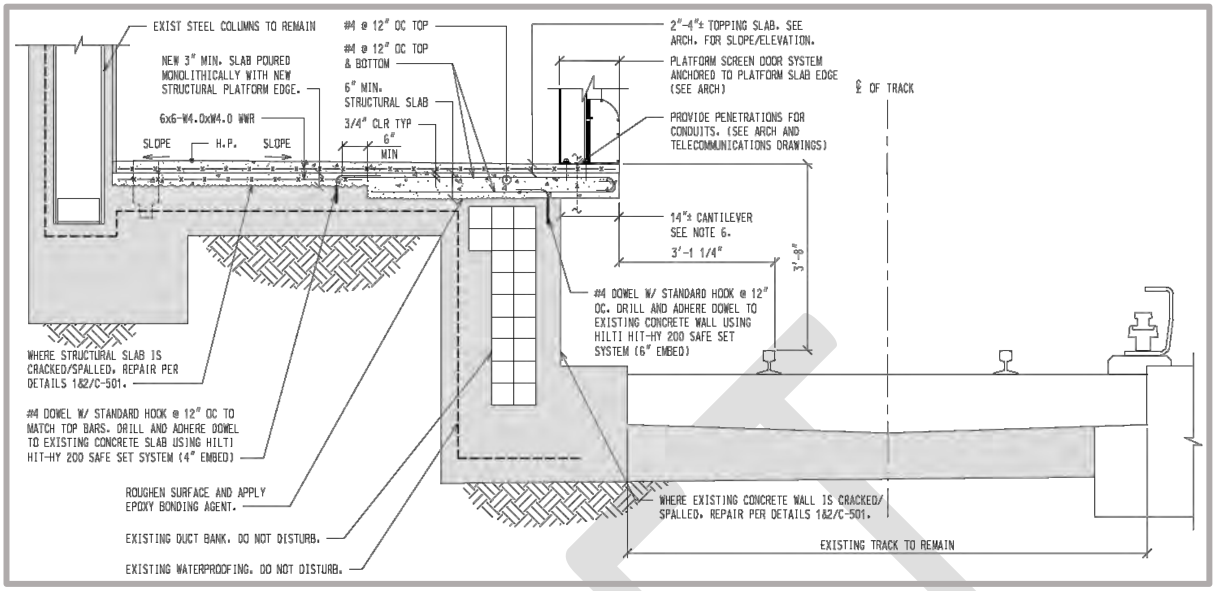


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

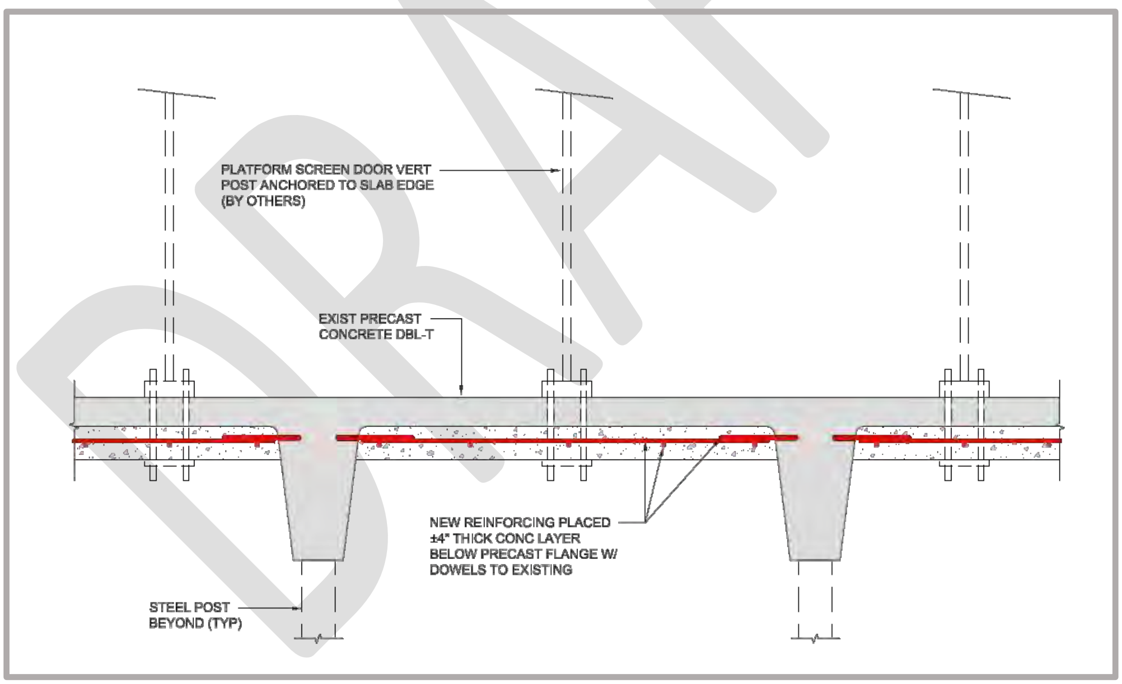


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

VJ ASSOCIATES
A CONSTRUCTION CONSULTING FIRM

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32518
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for 42nd Street Shuttle Line Stations
ESTIMATE DATE:	April 30, 2018

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 42nd Street Shuttle Line Stations

MTA/NYCT

April 30, 2018

BASIS OF ESTIMATE

1.00 Asbestos-Containing Materials (ACM) costs are excluded from this estimate.

2.00 Work is to be carried out during normal working hours - all train operations will be stopped

3.00 Escalation Cost is not included

4.00 Estimate includes costs associated with ADA zone concrete.

5.00 Estimate does not include State of Good Repair

6.00 NYCT project cost is not included

7.00 GO and flagging cost is not included

8.00 Maintenance / Operational Costs are not included. These will form part of a separate exercise

VJ ASSOCIATES

ORDER OF MAGNITUDE COSTS

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 42nd Street Shuttle Line Stations

MTA/NYCT

April 30, 2018

BASIS OF ESTIMATE

9.00 ***Description of typical APG / PSD installation:***

9.0.1 *APGs / PSDs will provide 22 emergency egress doors with push bars per platform*
9.0.2 *APGs will be 4'-6" foot high system cantilevered from the platform*
9.0.3 *Each platform edge will have 30 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
9.0.4 *Control Rooms will be as documented; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on platform)*
9.0.5 *Each Control Room will serve two platform edges*
9.0.6 *Control Rooms will be cooled to maintain operability of the control equipment*
9.0.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
9.0.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

9.0.9 *The existing platform edge lighting to be installed under contract A-35302 / A37116 is to be coordinated to suit the requirements of the PSD's*

BASIS OF ESTIMATE

9.0.10 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

9.1 ***Assumptions:***

9.1.1 *Two-foot wide platform edge finish and topping slab will be removed down to the structural slab and new granite tile/tactile warning tile will be installed on the platform side of the APGs (assumed width of finish on platform side of APGs is 1'-0")*

9.1.2 *All platforms will require structural rehabilitation to take APG loads*

9.1.3 *There are no special security requirements made necessary by installation of the APG system*

9.2 ***Exclusions - Costs not included in the estimate:***

9.2.1 *Costs associated with construction of remote Control Rooms (at locations other than inside the station)*

9.2.2 *Costs associated with changes to train signals or systems*

9.2.3 *Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length*

9.2.4 *Costs associated with NYCT State Of Good Repair improvements to the station*

BASIS OF ESTIMATE

9.2.5 *Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.*

9.2.6 *For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs*

9.3 ***Below the line or "soft" costs:***

9.3.1 *Design and Construction Contingency*
9.3.2 *Contractor O & P*
9.3.3 *Insurance*
9.3.4 *NYCT project costs not included*

9.5 ***Additional Notes***

9.5.1 *Given the limited time available, no drawings were developed to support this estimate.*

MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 42nd Street Shuttle Line Stations

LOCATION: 'S' LINE STATION, MANHATTAN

April 30, 2018

ORDER OF MAGNITUDE COSTS

	DESCRIPTION		GRAND CENTRAL	TIMES SQUARE
1	AUTOMATIC PLATFORM GATES (APG'S)		Excl.	$9,165,238
2	ADA ZONE		Excl.	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.
	TOTAL DIRECT COST		Excl.	$9,165,238
4	GENERAL REQUIREMENTS	15.00%	Excl.	$1,374,786
	SUB-TOTAL:		Excl.	$10,540,023
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	Excl.	$2,635,006
	SUB-TOTAL:		Excl.	$13,175,029
6	OVERHEAD & PROFIT	15.00%	Excl.	$1,976,254
	SUB-TOTAL:		Excl.	$15,151,284
7	BONDS & INSURANCE	3.75%	Excl.	$568,173
	SUB-TOTAL:		Excl.	$15,719,457
	SUB-TOTAL:		Excl.	$15,719,457
	SUBTOTAL CONSTRUCTION COST W/O ACM		Excl.	$15,719,457
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		Excl.	$15,719,457
10	DESIGN CONSULTANT FEES	10.00%	Excl.	$1,571,946
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.
	TOTAL PROJECT COST		Excl.	$17,291,403

MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 42nd Street Shuttle Line Stations

LOCATION: 'S' LINE STATION, MANHATTAN

April 30, 2018

ORDER OF MAGNITUDE COSTS

	DESCRIPTION		GRAND CENTRAL	TIMES SQUARE
	ADD ALTERNATIVES			
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		Excl.	1,404,773
	Add for Markups (as above)	88.66%	Excl.	1,245,512
			Excl.	$2,650,285

30-Apr-18

STATION: TIMES SQUARE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	GENERAL NOTES				
2	The estimate detail (lines 1 through 134 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (page 7 and 8) the total of the estimated detail line items below appears as the Total Direct Cost at the top of Page 7. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. A range of contingencies is described on page 8 and Alternative Option Premiums on Page 9.				
4	LENGTH OF THE PLATFORM EDGE [TRACK 1] =	315	LF		
5	LENGTH OF THE PLATFORM EDGE [TRACK 4] =	306	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	621	LF		
7					
8	AUTOMATIC PLATFORM GATES [APG's]				
9					
10	Platform edge reconstruction				
11	Demolition				
12	Remove existing polyethylene edge strip	621	LF	$7.00	4,347
13	Remove 5' wide section of 3" deep structural slab to platform edge	3,105	SF	$12.00	37,260
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	63	CY	$2,500.00	157,500
16	Pair of dowels (front & rear) cast into existing at 12" O.C	1,246	EA	$25.00	31,150
17	Cast in assemblies for PSD holding down bolts	384	EA	$180.00	69,120
18	Provide sleeves for HV & LV wires	192	EA	$110.00	21,120
19	Polyethylene edge strip	621	LF	$95.00	58,995
20					
21	Platform edge finishes				
22	Demolition				
23	Remove existing tactile warning strip 2' wide	621	LF	$15.00	9,315

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 42nd Street Shuttle Line Stations

30-Apr-18

STATION: TIMES SQUARE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
24	Remove existing platform tiles	2,484	SF	$8.00	19,872
25	Sawcut existing topping concrete at perimeter of removal area	621	LF	$5.00	3,105
26	Remove existing 3" concrete topping; Assuming 6' wide strip	3,726	SF	$8.00	29,808
27	New Work				
28	New concrete topping to match existing	621	SF	$15.00	9,315
29	New Granite tiles to match existing	1,908	SF	$60.00	114,480
30	Provide new 2' wide Tactile Strip at location of doors only	288	LF	$110.00	31,680
31	Misc. patchwork	1	LS	$50,000.00	50,000
32					
33	**Equipment Room [Refer PSK 2.3]**				
34	Build off existing track level		Note		
35	Form 8" wide concrete curb including dowelling to platform slab	79	LF	$90.00	7,110
36	CMU Wall for equipment room - Assume 8' high	632	SF	$45.00	28,440
37	Fire rated door including frame & hardware	1	EA	$2,500.00	2,500
38	Exterior wall finish				
39	Ceramic Tiling to match existing	360	SF	$40.00	14,400
40	Mosaic Band to match existing - Assuming 8" high	36	LF	$120.00	4,320
41	Concrete cove to match existing	36	LF	$20.00	720
42	Interior Wall Finish - Paint	632	SF	$5.00	3,160
43	Allow for Misc. floor & ceiling finishes	340	SF	$15.00	5,100
44	Allow for 4" thick concrete pads for equipment	85	SF	$20.00	1,700
45	Allowance for Mechanical Scope	1	LS	$40,000.00	40,000
46	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	$60,000.00	60,000
47	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	$100,000.00	100,000
48	Allowance to bring fiber optic to Control Room from network node	1	LS	$15,000.00	15,000
50	**Automatic Platform Gates [APGs] - 4'-6" High**				
51	Automatic bi-parting gates; Assumed 6'-0" wide (6 Cars x 4 Doors = 24 No. per platform)	48	EA	$15,000.00	720,000
52	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #22 per Platform	44	EA	$10,500.00	462,000

30-Apr-18

STATION: TIMES SQUARE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
53	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	$20,000.00	40,000
54	Platform End Gates (PEGs)	4	EA	$13,000.00	52,000
55	Fixed Panels including framing and support; 4'-6" High	905	SF	$850.00	768,825
56	Spare Parts - Approx. 10% of Material Cost	1	LS	$180,000.00	180,000
57	Testing and commissioning	800	HRS	$159.93	127,944
58	Product Warranty	1	LS	$1,000,000.00	1,000,000
59	Allowance for Braille Signage	48	EA	$2,500.00	120,000
60					
61	Electrical				
62	Electrical Upgrades				
63	Reference Tier 2/3 Report [Page 7 of 9], there is adequate power is available to cater for additional load required by above scope		Note		EXCL.
64	Power and Lighting				
65	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	$200,000.00	200,000
66	Allow for conduit / cable runs for power and communications under platform edge	2,484	LF	$60.00	149,040
	PSD Connections	1	LS	$75,000.00	75,000
68	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	LS	$200,000.00	200,000
69	Allowance to bring power to Equipment Room from EDR including track crossing	1	LS	$20,000.00	20,000
70	Reference Tier 2/3 Report [Page 1 of 9], No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
71	Grounding				
72	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	LS	$30,000.00	30,000
73	MISC				
74	Testing and commissioning	1	LS	$30,000.00	30,000
75	As Built, Shop Drwgs, Permits and approvals	1	LS	$20,000.00	20,000
76					
77	Communications				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 42nd Street Shuttle Line Stations

30-Apr-18

STATION: TIMES SQUARE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
78	FA System				
79	Scope in connection with Fire Alarm System	1	LS	$100,000.00	100,000
80	CCTV coverage				
81	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	60	EA	$12,000.00	720,000
82	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	$100,000.00	100,000
83	Berthing Technology Sensors				
84	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	8	EA	$16,000.00	128,000
85	Train Door Detection System				
86	Train Door Detection Sensor including software and hardware requirements	8	EA	$15,000.00	120,000
87	Entrapment concerns				
88	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	144	EA	$4,629.24	666,611
89	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	144	EA	$5,565.56	801,441
90	Engineering and Testing	2,000	Hrs	$159.93	319,860
91	Centralized monitoring/control				
92	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	$70,000.00	70,000
93	MISC				
94	Penetration, patching, selective demo and minor modifications	1	LS	$25,000.00	25,000
95	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	$40,000.00	40,000
96	Site Survey and Inspections	1	LS	$100,000.00	100,000
97	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	$150,000.00	150,000
98	Furnish Test Equipment allowance	1	LS	$500,000.00	500,000

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 42nd Street Shuttle Line Stations

30-Apr-18

STATION: TIMES SQUARE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
99	As Built, Shop Drwgs, Permits and approvals	1	LS	$50,000.00	50,000
100					
101	Out of hours Work				
102	No allowance included for work outside normal working hours		Note		EXCL.
103					
104	Training				
105	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	$150,000.00	150,000
107	TOTAL PSD WORK:				$ 9,165,238

109					
110	ADD ALTERNATIVE				
111					
112	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
113					
114	ADD				
115	Automatic bi-parting doors (6 Cars x 4 Doors = 24 No. per platform)	48	EA	$25,000.00	1,200,000
116	'Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #22 per Platform	44	EA	$15,000.00	660,000
117	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	$30,000.00	60,000
118	Platform End Gates (PEGs)	4	EA	$18,000.00	72,000
119	Fixed Panels including framing and support; Assuming 8'-0" high	2,168	SF	$750.00	1,626,210
120	Structual bracing for full height PSDs	1	LS	$250,000.00	250,000
121	Spare Parts - Approx. 10% of Material Cost	1	LS	$220,000.00	220,000
122					
123	OMIT				
124	Automatic bi-parting gates; Assumed 6'-0" wide (6 Cars x 4 Doors = 24 No. per platform)	-48	EA	$15,000.00	(720,000)
125	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #22 per Platform	-44	EA	$10,500.00	(462,000)
126	Double egress/service gate in the center of the platform; #1 per Platform	-2	EA	$20,000.00	(40,000)

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for 42nd Street Shuttle Line Stations

30-Apr-18

STATION: TIMES SQUARE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
127	Platform End Gates (PEGs)	-4	EA	$13,000.00	(52,000)
128	Fixed Panels including framing and support; 4'-6" High	-905	SF	$850.00	(768,825)
129	Spare Parts - Approx. 10% of Material Cost	-1	LS	$180,000.00	(180,000)
130	Remove allowance for cast in sleeves for LV & HV power	-192	EA	$110.00	(21,120)
131	Conduit running under Platform Edge	-1	LS	$60,000.00	(60,000)
132	Platform Edge Reconstruction work	-1	LS	$379,492.00	(379,492)
133					
134	PREMIUM ASSOCIATED WITH PSD's				1,404,773

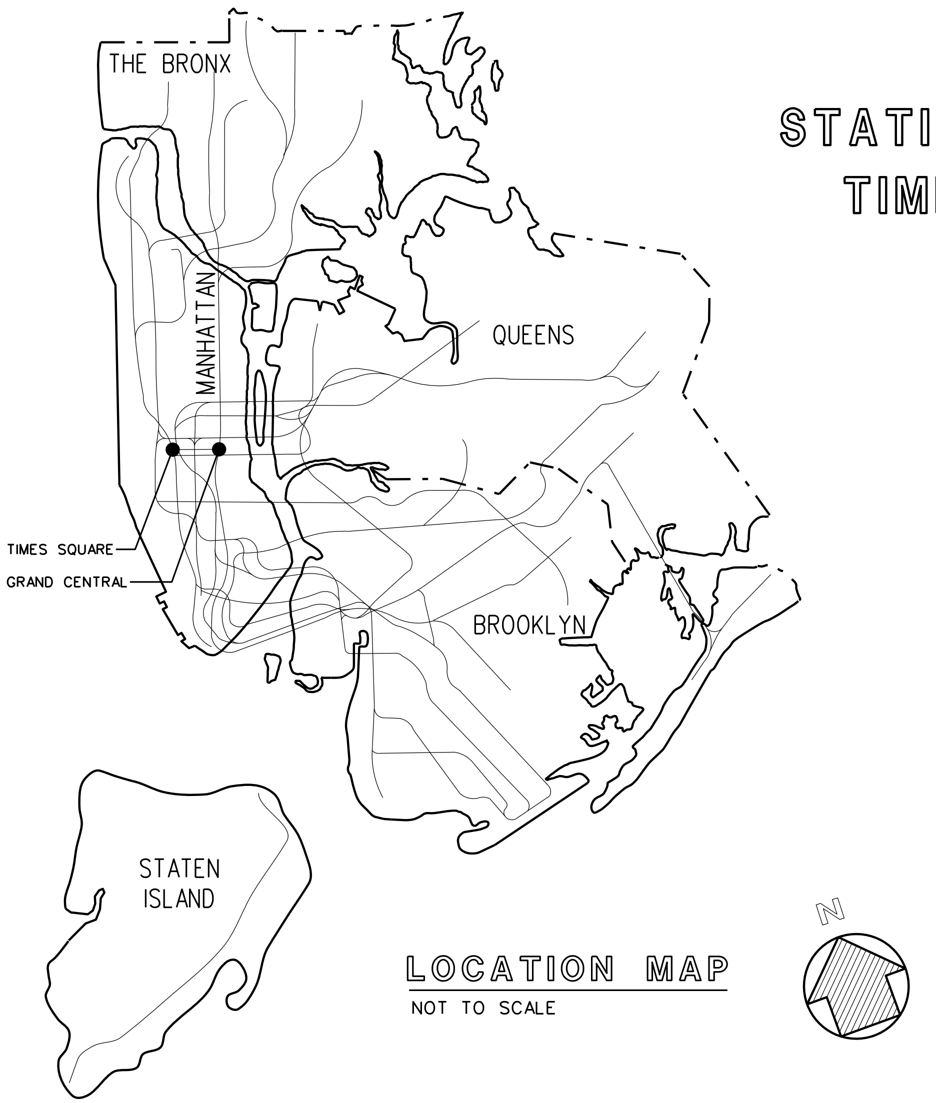
THE METROPOLITAN TRANSPORTATION AUTHORITY
ACTING BY
THE NEW YORK CITY TRANSIT AUTHORITY

NEW YORK CITY TRANSIT

CONTRACT A-35302 / A-37116

STATION RECONSTRUCTION & ADA ACCESSIBILITY
TIMES SQUARE & GRAND CENTRAL STATIONS
42ND STREET SHUTTLE LINE (IRT)
BOROUGH OF MANHATTAN

FINAL DESIGN
VOLUME 1 OF 2



LOCATION MAP

NOT TO SCALE

Summary set:

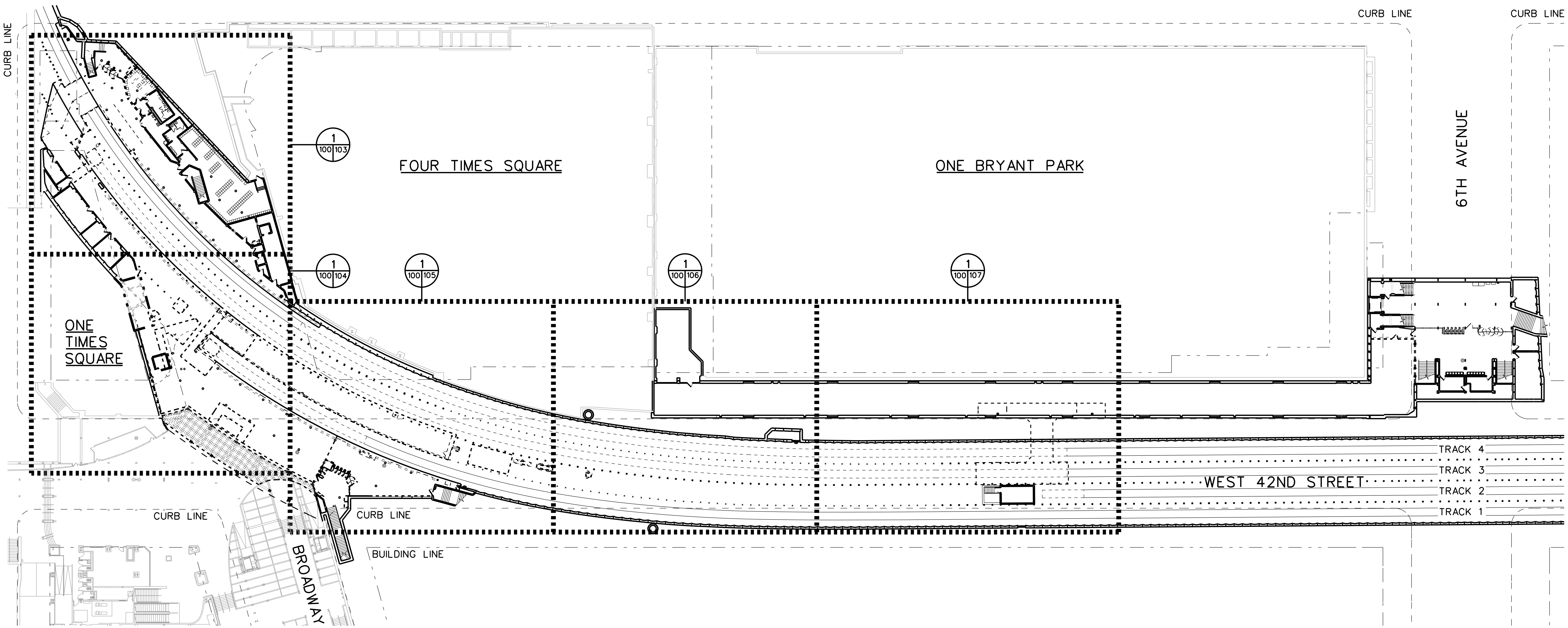
A-100 - TIMES SQUARE SHUTTLE DEMOLITION PLAN
A-101 - TIMES SQUARE SHUTTLE CONSTRUCTION KEY PLAN
A-146 - TIMES SQUARE SHUTTLE SECTIONS PLATFORM
A-200 - GRAND CENTRAL SHUTTLE DEMOLITION PLAN
A-200A - GRAND CENTRAL SHUTTLE CONSTRUCTION KEY PLAN
A-226 - GRAND CENTRAL SHUTTLE SECTIONS PLATFORM

ASHOK PATEL, R.A.
DESIGN MANAGER
STATIONS PROGRAM

DATE

ALOK SAHA, P.E.
VICE PRESIDENT AND DEPUTY CHIEF ENGINEER
ENGINEERING SERVICES

DATE



1 100 100 DEMOLITION KEY PLAN
PLATFORM LEVEL

FT 0 16 32 64

N

REVISION	DESCRIPTION	DATE	APPROVED

New York City Transit Authority

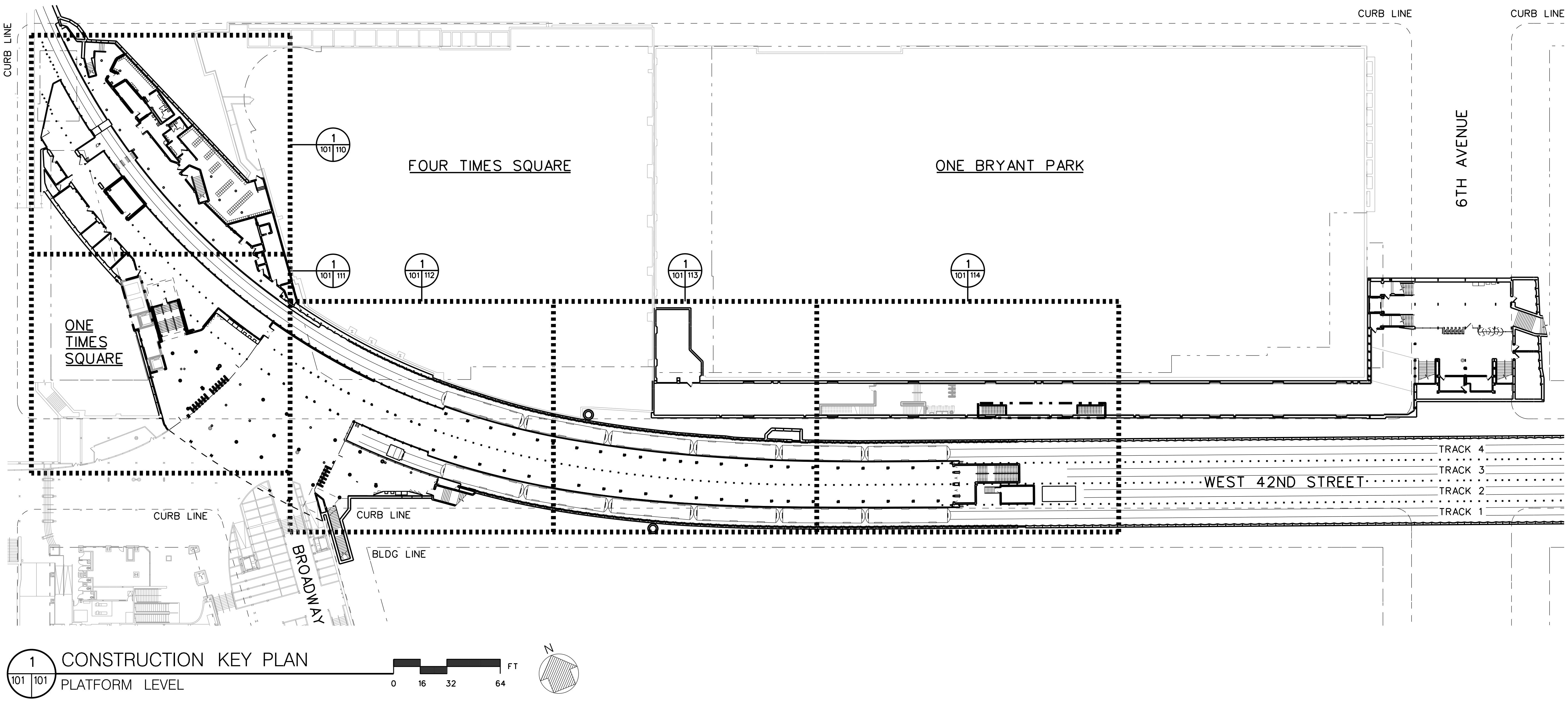
CONTRACT A-35302/37116
STATION RECONSTRUCTION & ADA ACCESSIBILITY
TIMES SQUARE & GRAND CENTRAL STATIONS
42ND STREET SHUTTLE (IRT) IN THE BOROUGH OF MANHATTAN

DEPARTMENT OF CAPITAL PROGRAM MANAGEMENT
ARCHITECTURE

TIMES SQUARE SHUTTLE
DEMOLITION KEY PLAN
PLATFORM LEVEL

DRAWN BY	RAFAEL DE CARVALHO
DESIGNED BY	RAFAEL DE CARVALHO
CHECKED BY	GUSTAVO PONZOA R.A.
APPROVED BY	GIUSEPPE SCALIA R.A.

DATE : 09/25/2017
DRAWING NO. A-100
REVISION



1 101 101 CONSTRUCTION KEY PLAN
PLATFORM LEVEL

REVISION	DESCRIPTION	DATE	APPROVED

New York City Transit Authority

CONTRACT A-35302/37116
STATION RECONSTRUCTION & ADA ACCESSIBILITY
TIMES SQUARE & GRAND CENTRAL STATIONS
42ND STREET SHUTTLE (IRT) IN THE BOROUGH OF MANHATTAN

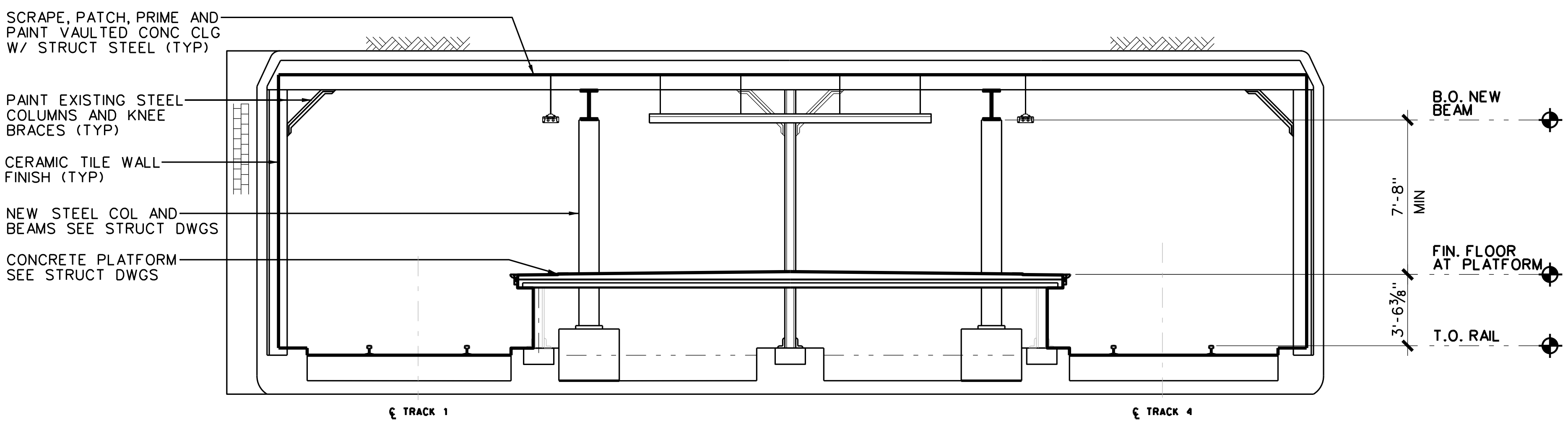
DEPARTMENT OF CAPITAL PROGRAM MANAGEMENT
ARCHITECTURE

TIMES SQUARE SHUTTLE
CONSTRUCTION KEY PLAN
PLATFORM LEVEL

DRAWN BY	RAFAEL DE CARVALHO	DATE : 09/25/2017
DESIGNED BY	RAFAEL DE CARVALHO	DRAWING NO.
CHECKED BY	GUSTAVO PONZOA R.A.	A-101
APPROVED BY	GIUSEPPE SCALIA R.A.	REVISION

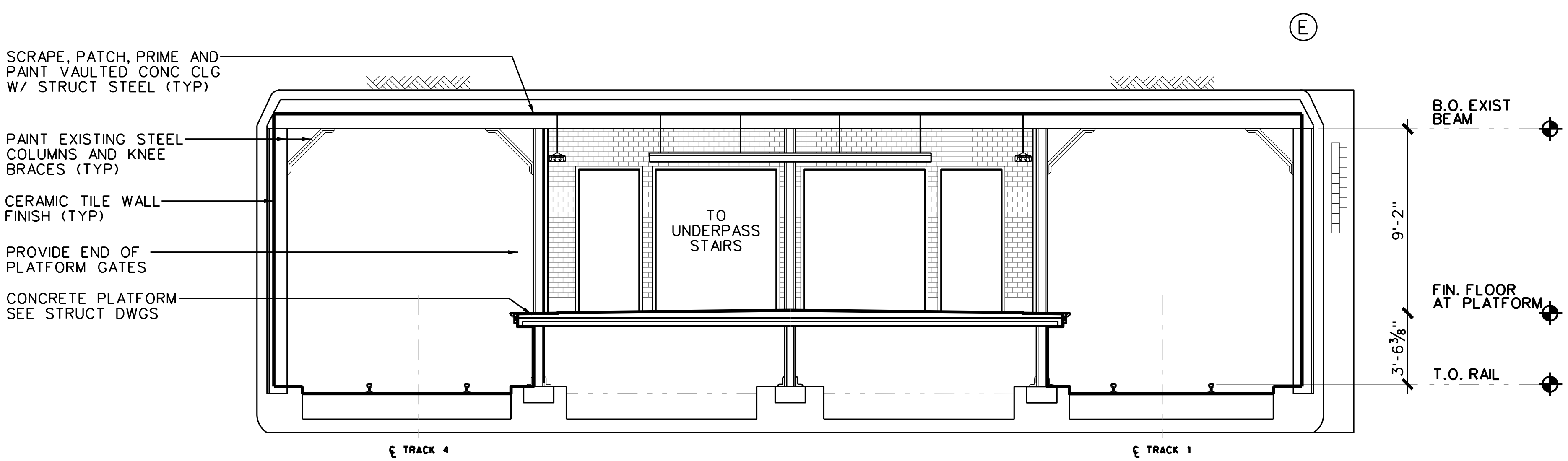
REFERENCES

1 FOR STRUCTURAL WORK AT PLATFORM LEVEL SEE DRAWING C-XXX.



1 114 146 PLATFORM SECTION
TOWARD WEST

FT 0 2 4 8



2 114 146 PLATFORM SECTION
TOWARD EAST

FT 0 2 4 8

REVISION	DESCRIPTION	DATE	APPROVED

New York City Transit Authority

CONTRACT A-35302/37116
STATION RECONSTRUCTION & ADA ACCESSIBILITY
TIMES SQUARE & GRAND CENTRAL STATIONS
42ND STREET SHUTTLE (IRT) IN THE BOROUGH OF MANHATTAN

DEPARTMENT OF CAPITAL PROGRAM MANAGEMENT
ARCHITECTURE

TIMES SQUARE SHUTTLE
SECTIONS
PLATFORM

DRAWN BY	JORGE ANDRES DIAZ	DATE : 09/25/2017
DESIGNED BY		DRAWING NO.
CHECKED BY	GUSTAVO PONZOA R.A.	A-146
APPROVED BY	GIUSEPPE SCALIA R.A.	REVISION

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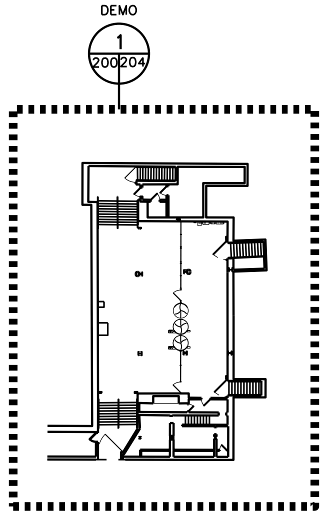
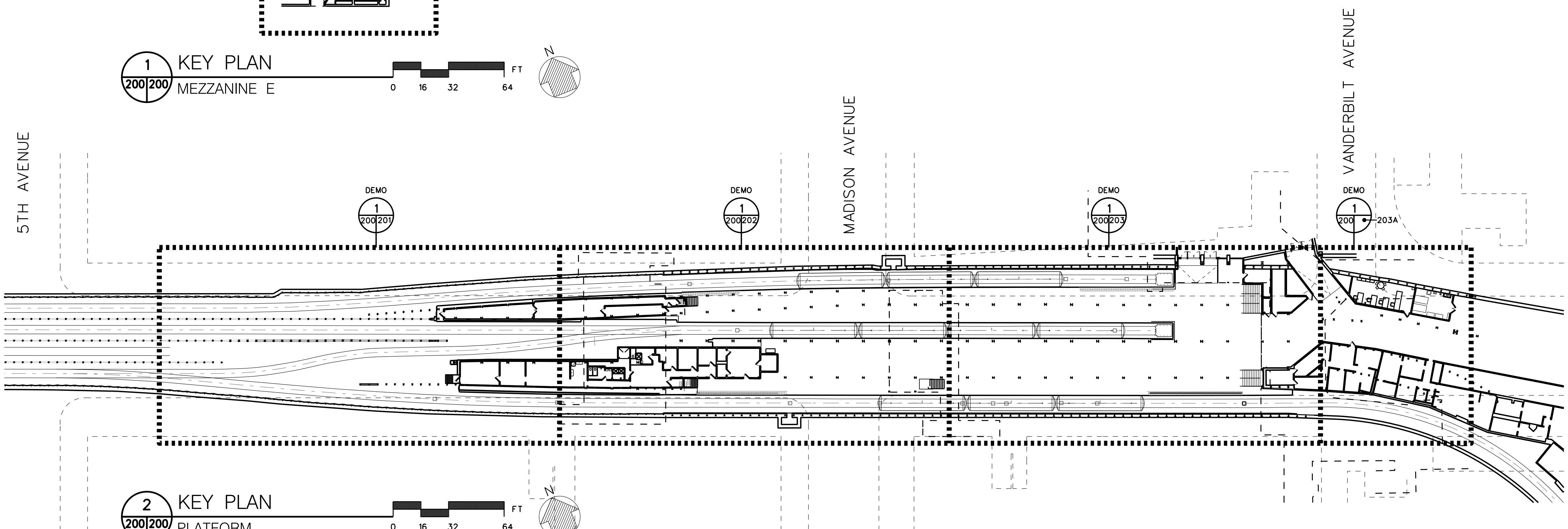


1 200 200 KEY PLAN
MEZZANINE E



2 200 200 KEY PLAN
PLATFORM

REVISION	DESCRIPTION	DATE	APPROVED

New York City Transit Authority

CONTRACT A-35302/37116
STATION RECONSTRUCTION & ADA ACCESSIBILITY
TIMES SQUARE & GRAND CENTRAL STATIONS
42ND STREET SHUTTLE (IRT) IN THE BOROUGH OF MANHATTAN

DEPARTMENT OF CAPITAL PROGRAM MANAGEMENT
ARCHITECTURE

GRAND CENTRAL SHUTTLE DEMOLITION KEY PLAN

DRAWN BY	SIMON HO	DATE : 09/25/2017
DESIGNED BY	SIMON HO	DRAWING NO.
CHECKED BY	GUSTAVO PONZOA R.A.	A-200
APPROVED BY	GIUSEPPE SCALIA R.A.	REVISION

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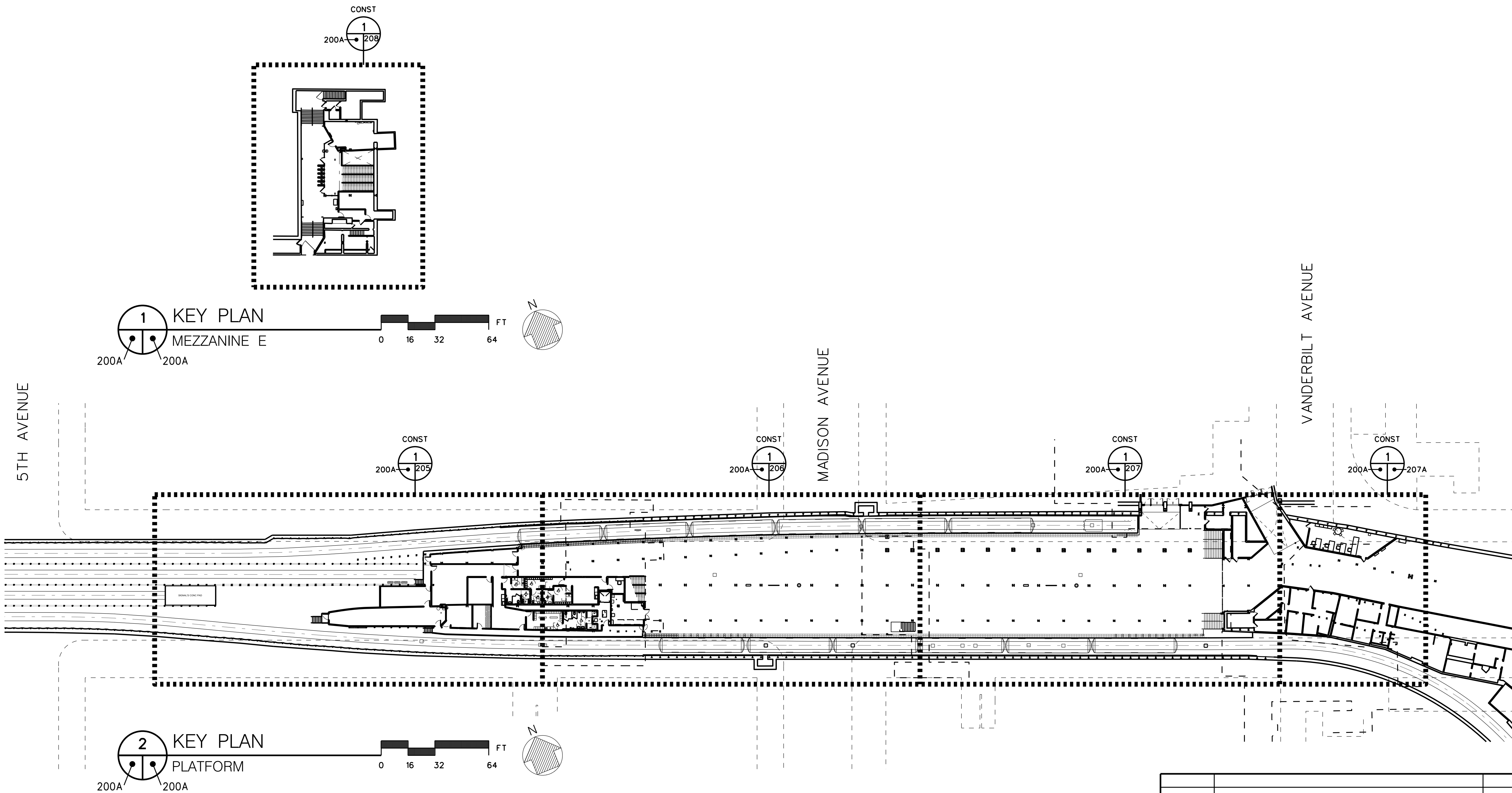


REVISION	DESCRIPTION	DATE	APPROVED

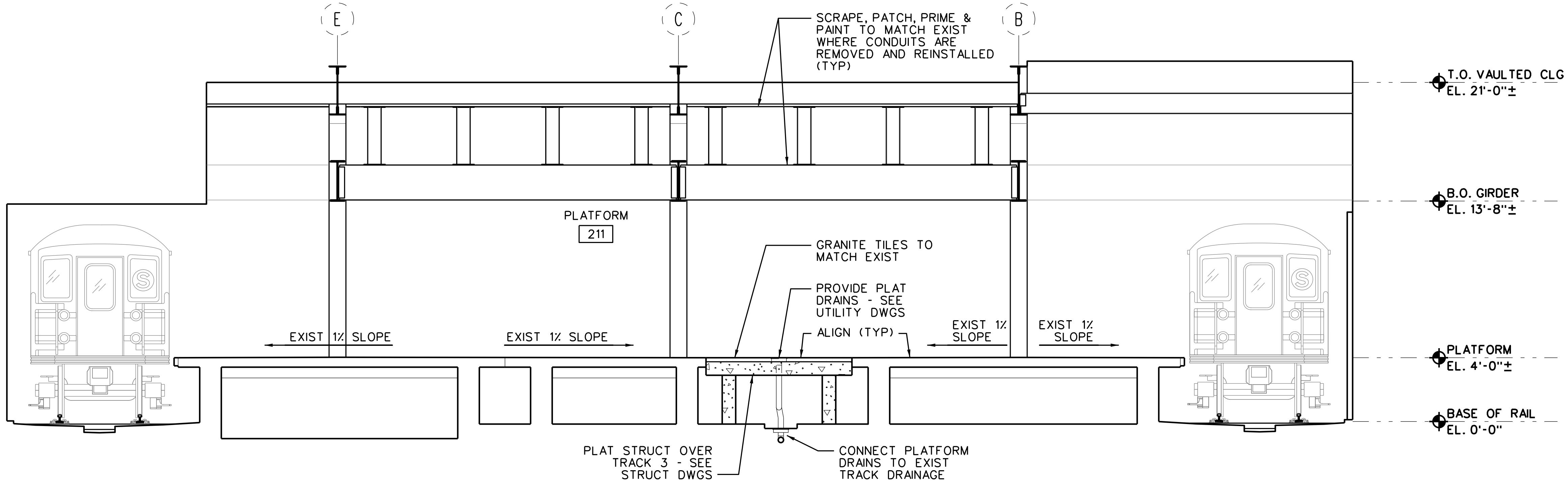
CONTRACT A-35302/37116
STATION RECONSTRUCTION & ADA ACCESSIBILITY
TIMES SQUARE & GRAND CENTRAL STATIONS
42ND STREET SHUTTLE (IRT) IN THE BOROUGH OF MANHATTAN

New York City Transit Authority

DEPARTMENT OF CAPITAL PROGRAM MANAGEMENT
ARCHITECTURE

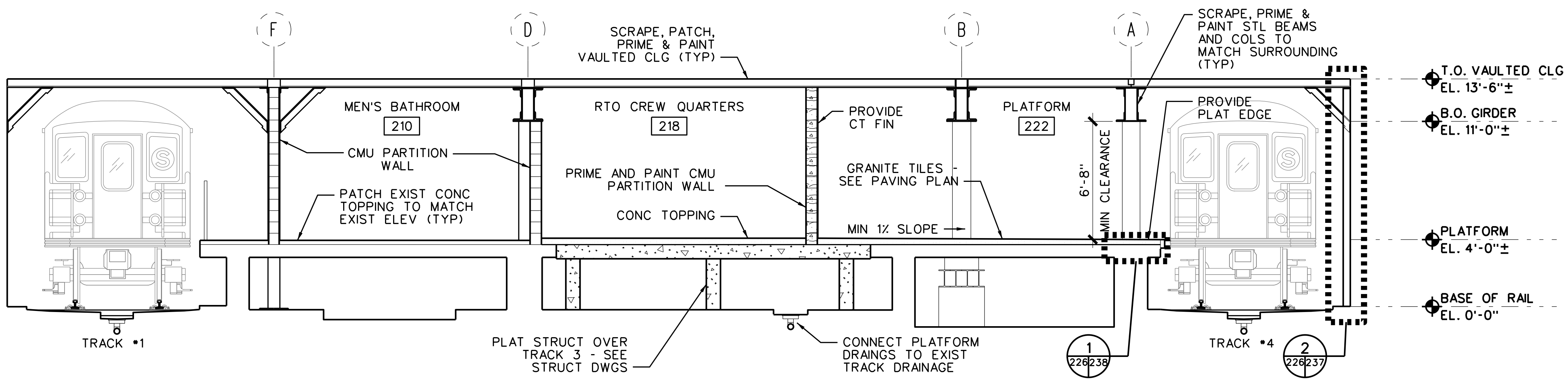
GRAND CENTRAL SHUTTLE CONSTRUCTION KEY PLAN

DRAWN BY	SIMON HO	DATE : 09/25/2017
DESIGNED BY	SIMON HO	DRAWING NO.
CHECKED BY	GUSTAVO PONZOA R.A.	A-200A
APPROVED BY	GIUSEPPE SCALIA R.A.	REVISION



1 | 206 | 226 SECTION PLATFORM

FT 0 2 4 8



2 | 205 | 226 SECTION PLATFORM

FT 0 2 4 8

REFERENCES

1 FOR PLATFORM CONSTRUCTION SEE STRUCT DWGS
2 FOR WALL TYPE CONSTRUCTION SEE DWG A-304

REVISION	DESCRIPTION	DATE	APPROVED

New York City Transit Authority

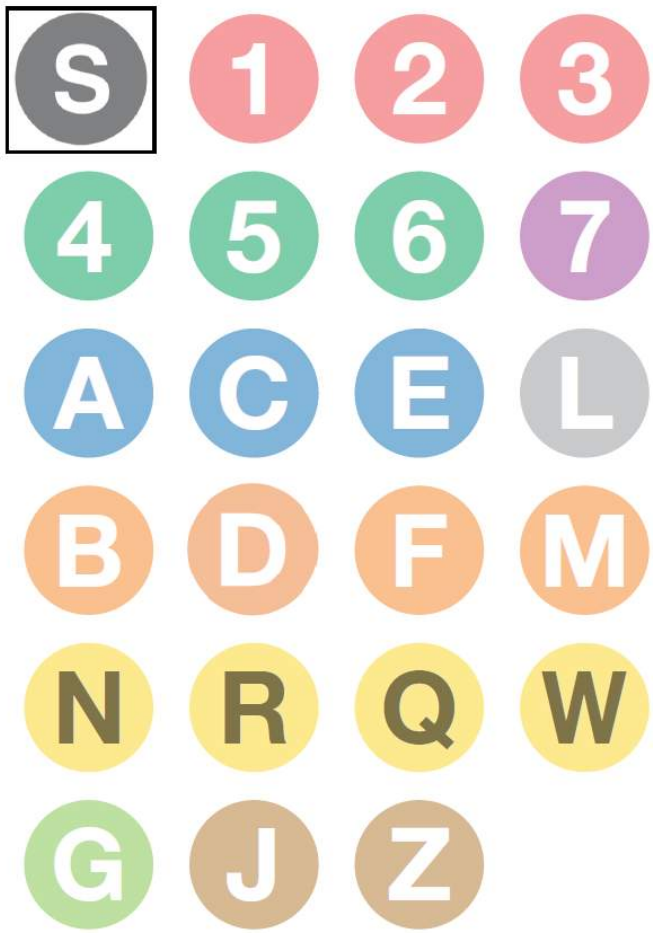
CONTRACT A-35302/37116
STATION RECONSTRUCTION & ADA ACCESSIBILITY
TIMES SQUARE & GRAND CENTRAL STATIONS
42ND STREET SHUTTLE (IRT) IN THE BOROUGH OF MANHATTAN

DEPARTMENT OF CAPITAL PROGRAM MANAGEMENT
ARCHITECTURE

GRAND CENTRAL SHUTTLE PLATFORM SECTIONS

DRAWN BY	SIMON HO	DATE : 09/25/2017
DESIGNED BY	SIMON HO	DRAWING NO.
CHECKED BY	GUSTAVO PONZOA R.A.	A-226
APPROVED BY	GIUSEPPE SCALIA R.A.	REVISION

New York City Transit



REPORT ON FEASIBILITY OF PLATFORM EDGE BARRIERS FOR 'S - FRANKLIN LINE' SERVICE STATIONS

CONTRACT #: C-32516 | STV PROJECT #: 3017214

FINAL SUBMITTAL DATE: July 26, 2019

STV 100 Years

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Executive Summary

In our ongoing study of all 472 stations of NYCT, this report builds on the initial feasibility studies previously submitted. Previous studies include:

- A study to identify a location for a pilot installation of Platform Screen Doors (PSD) at a revenue station. A summary of the technology and feasibility criteria sections of that report is included in Appendix A of this report for reference.
- A structural study of typical platform construction and it's suitability for handling PSD loads across the NYCT system. That study is included for reference in Appendix B of this report.
- A study of the impact to station egress of platform screen doors: Appendix C

This system-wide study follows a Tier 1, 2, 3 methodology of progressively detailed analysis, with Tier 1 examining vehicles and generic characteristics, and Tier 2 and 3 looking at localized physical characteristics of individual stations. Our Tier 1 analysis found no instances of door misalignment between car classes for this line. This Tier 2/3 report looks at issues of obstructions near the platform edge, platform width, structural constraints, location of the equipment room, and an evaluation of available power.

Of these 4 newly evaluated stations, 1 has been found to be not suitable for the installation of PSDs.

[Note: the term "PSD" is used to universally include both full-height and half-height barrier systems. The term "APG" (Automatic Platform Gate) refers only to half-height barriers]

The following points summarize the major constraints to installing a PSD system:

- ADA clearance issues: the platform edge barriers are 15" wide. Where an existing object (wall, stair, and railing) is close to the platform edge, the addition of the PSD can further constrain the available space. Under the following conditions, PSDs are declared infeasible:
  - Limit the ability of a wheelchair to turn within a 5'-0" circle
  - Limit path of travel to less than a 32" pinch width (defined as an obstruction that measures less than 2'-0" longitudinally, i.e. columns)
  - Limit path of travel to be less than a 36" corridor as defined by the edge of a staircase, railing or room
- Insufficient space for the PSD equipment room: the equipment room can be built as one long room (7'-6" x 27') or two smaller rooms (7'-6" x 17'). Many stations do not have available space for these rooms.
- Platforms that are too narrow: due to the out-swinging emergency egress doors which are part of the PSD barrier, many platforms do not provide enough width to facilitate egress in an emergency. Please see Appendix C which provides a complete explanation of code requirements regarding the placement of these new barriers in an existing station environment.
- Structural considerations: existing pre-cast panels which are typically found at elevated platforms cannot support the added load of PSDs / APGs. The installation of PSDs at precast elevated platforms was a subject of analysis in the Structural Feasibility Report of April 2018 (See Appendix B). As noted there, PSDs would require full replacement of the platform thus changing the scope of a PSD project from an Alteration 2 to an Alteration 3 and triggering a full seismic

upgrade to the existing station structure. Such extensive work would not be in proportion to the benefit.

- Columns at platform edge: at certain stations, the columns are positioned 16" to 24" from the platform edge. While this dimension allows for the 15"-wide APG/PSD system, installation and maintenance cannot be carried out due to the lack of clear space.

Note that a determination of full feasibility will require two additional steps:

- Computational Fluid Dynamics (CFD) analysis; the installation of PSDs introduces a significant barrier to air flow at underground stations. Based upon CFD analyses done for the half-height automated platform gates (APGs) of the previously proposed 3rd Avenue pilot station, such installations are likely to be successful in underground stations. However, it is assumed if/when design of APG/PSDs are initiated at any future stations CFD analysis will be performed as part of the design process.
- An NFPA130 timed egress analysis for the existing stations or for potential PSD designs is also beyond the scope of this study, however a generic review of the impact of PSD installation on egress capacity (Appendix C) has informed the findings of this feasibility study. This conceptual review looked at the impact of PSDs on egress from the platform, especially the impact of the outward-swinging emergency egress doors which are part of the PSD system. The PSD barrier is approximately 15" in thickness; with the emergency egress doors in their outward swinging open position, the PSD barriers and doors collectively subtract 3'-1" from platform width. At certain narrow platforms, this reduction of width would exceed code-mandated limits. See Appendix C for more detail.

A garbage train is not used for refuse removal at the Franklin Avenue shuttle stations. Therefore no special provisions are necessary to accommodate the collection of refuse along the platform edge barrier.

The table on the following page summarizes these findings and shows that platform edge barriers are feasible at 75% of the 'S' Line Stations. Total implementation cost would be \$36.9M for APGs and \$41.3M for PSDs. An estimate of maintenance cost was performed for the proposed pilot station at 3rd Avenue; that estimate can reasonably be applied in the calculation of estimated maintenance costs at all two-platform stations. It shows an annual maintenance cost of \$931,000 per station for the first three years of maintenance, (see Appendix D) therefore for the 3 feasible stations, the aggregate annual maintenance cost would be \$2.8M.

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Summary Table

(75% Feasible 3/4)

MRN No.	Station Names	Station Type	Platform Type	Feasibility	Issues/Reason for Failure	Cost APGs	Cost PSDs
042	Prospect Park	CUT	Island	No	ADA Clearance	-	-
139	Franklin Avenue	ELV	Side	Yes		$11.4M	$12.5M
141	Park Place	ELV	Side	Yes		$11.3M	$12.4M
142	Botanic Gardens	SUB	Side	Yes		$14.1M	$16.4M
					TOTAL	**$36.9M**	**$41.3M**

1.0 Station Assessments

1.01 – MR 042 | Prospect Park Station

Summary: *Prospect Park Station is not feasible for both APGs and PSDs as their implementation would result in non-compliant ADA conditions. In the implementation of a platform edge barrier, the 36" corridor requirement for ADA compliant wheelchair movement would not be met as the remaining width would be 31" (see figure 1).*

Description

The Prospect Park Station is an open cut station with two straight center / island platforms. The platform structures are cast-in-place concrete. The width of the platforms at the north end is 3'-10". The implementation of a platform edge barrier would reduce this width below the required minimum of 36". The remaining 31" or less* would not allow for ADA compliant wheelchair movement. See figure 1 for reference.

*Please note that the ADA clearance measurements are subject to a slight decrease due to the required placement of PSD/APG equipment outside the Limiting line of line equipment (LLLE), which is dictated by the dynamic envelope of the trains.=

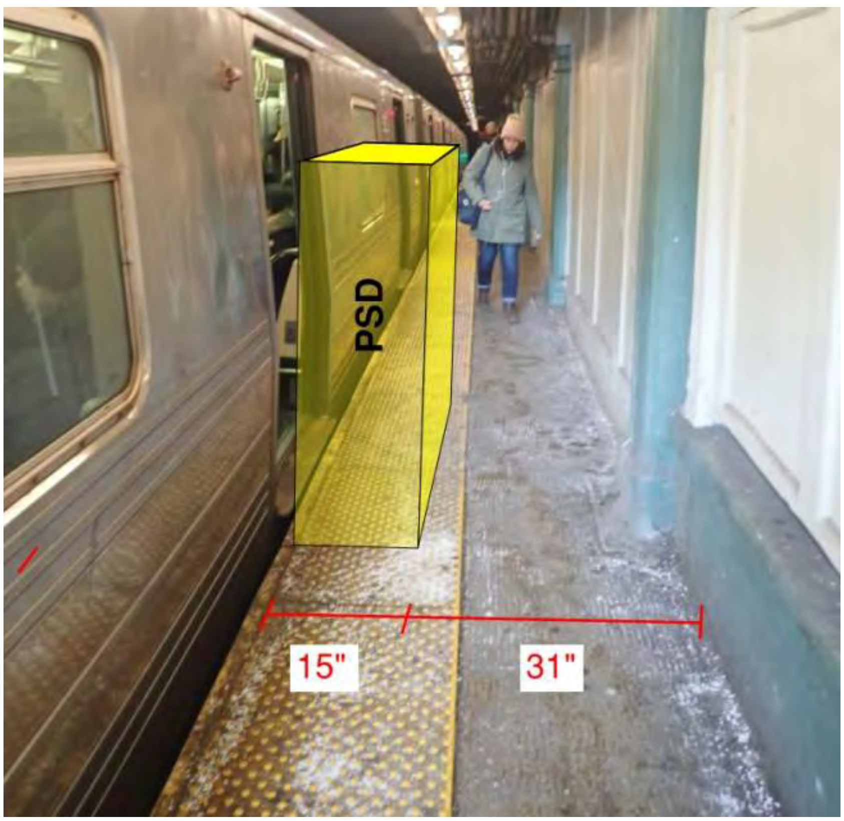

Figure 1 *– Non-compliant ADA condition*
Prospect Park Station

1.02 – MR 139 | Franklin Avenue Station

Summary: *Franklin Avenue Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Franklin Avenue Station is an elevated station with one straight side platform **(see Figure 1)**. The platform structure is cast-in-place concrete. There are no platform columns. The platform width varies from approximately 11'-6" to 24'-4". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to be located in coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the center of the platform, flush to the back wall (**see Figure 1, Figure 2)**. The proposed room dimension is 27'-0" x 6-6".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would have to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

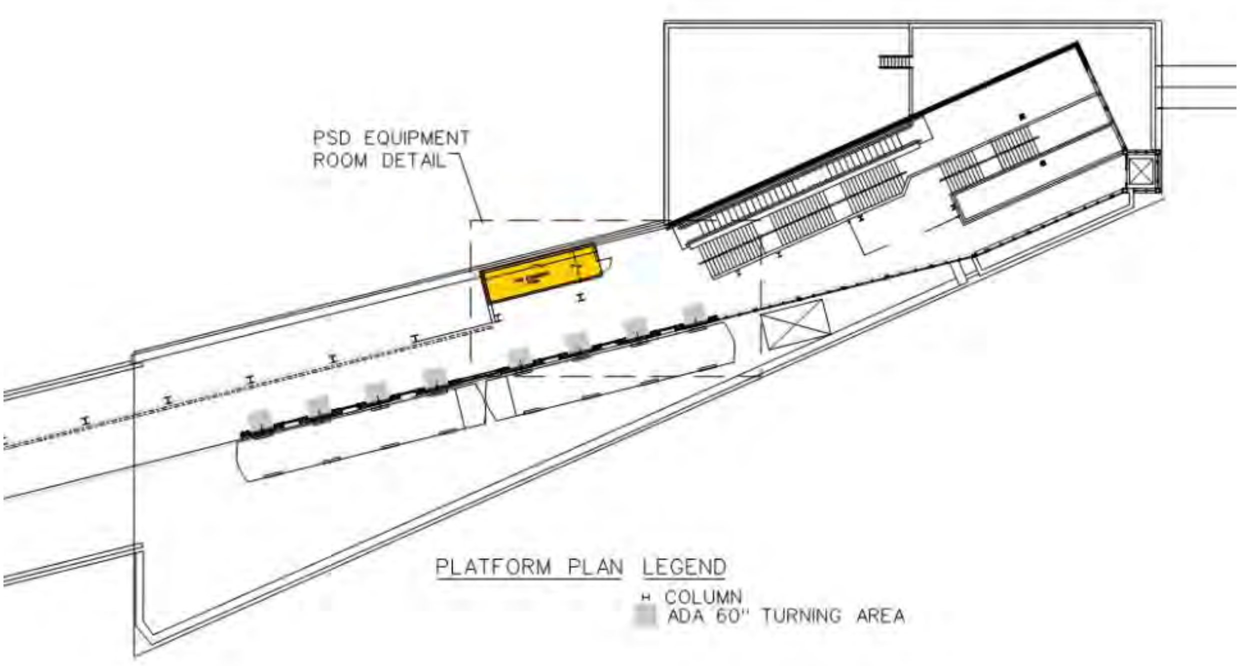

Figure 1 – *Overall Station Plan*
Franklin Avenue Station

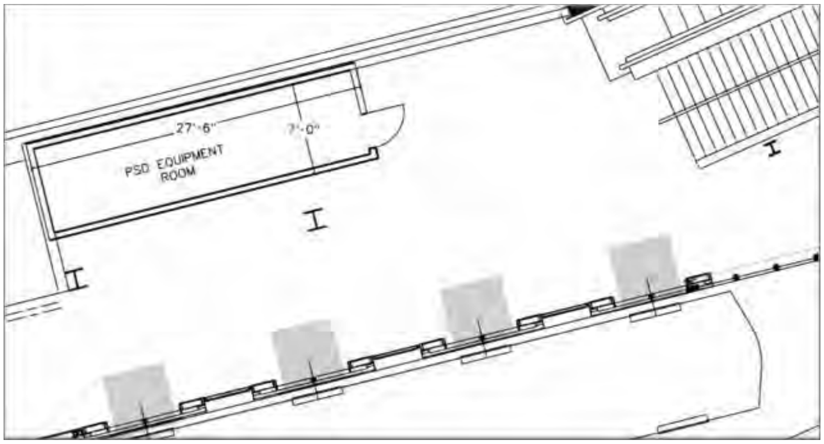

***Figure 2** – PSD Equipment Room 1 Detail*

Platform obstructions within 5' of edge:

- None

Lighting:

Existing lighting: Throughout the platform there is linear florescent lighting parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG/PSD system. We do not consider a lack of adequate existing power to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project.
Below in Table 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Franklin Avenue
Peak Demand Load from ConEd Report, (kW)	66.4
Apparent Power (kVA)	83.0
Station Peak Demand Load, Max Current, (A)	230.6
Maximum Amount of Doors	8.0
PSD Total Load Including All Miscellaneous Loads, (A)	63.2
Total Load (Station Peak + PSD), (A)	294
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	906
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 1200A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Franklin Avenue
Peak Demand Load from ConEd Report, (kW)	10.4
Apparent Power (kVA)	13.0
Station Peak Demand Load, Max Current, (A)	36.1
Maximum Amount of Doors	8.0
PSD Total Load Including All Miscellaneous Loads, (A)	63.2
Total Load (Station Peak + PSD), (A)	99
Station Service Power Capacity, (A)	1200
Service Spare Capacity, (A)	1101
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 1200A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service.

Table 2. Power Capacity Analysis

Figure 3 *– General platform view*
Franklin Avenue Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $11.4M to install APGs and $12.5M to install PSDs (See Appendix E).

1.03 – MR 141 | Park Place Station

Summary: *Park Place Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Park Place Station is an elevated station with one straight side platform **(see Figure 1)**. The platform structure is cast-in-place concrete. There are no platform columns. The platform width is approximately 11'-4" throughout. Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at grade near Prospect Place. (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

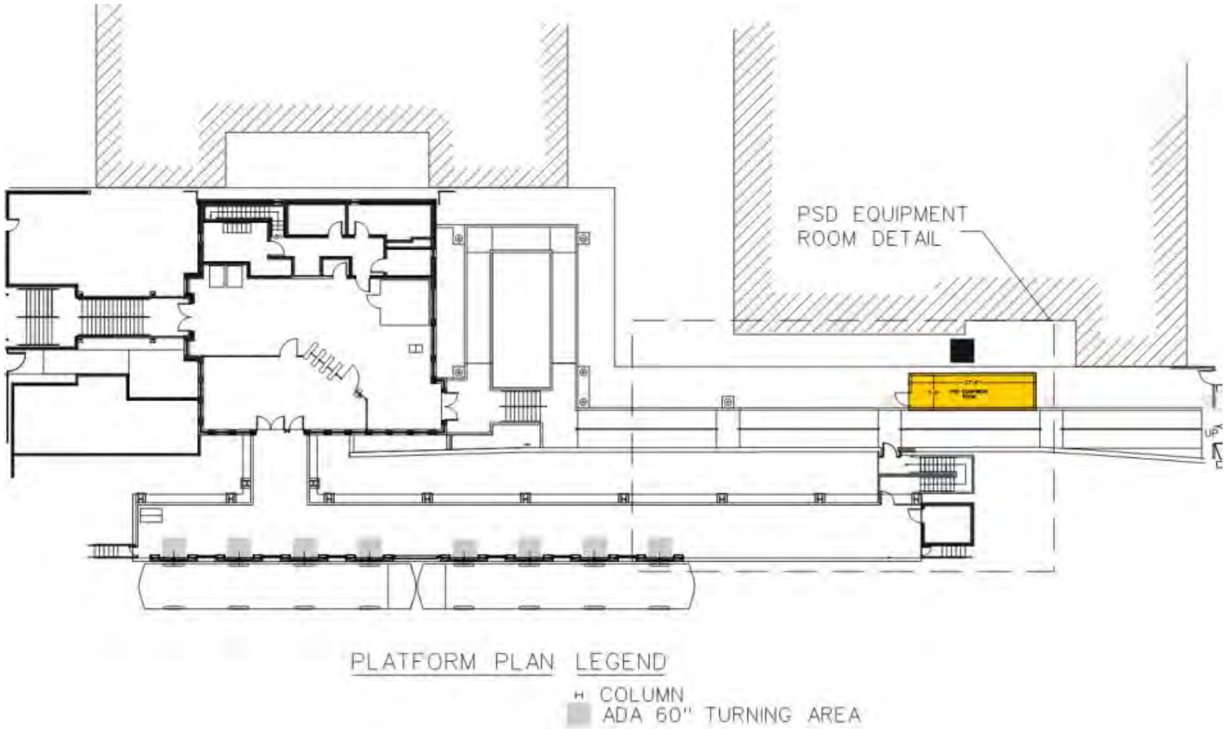

***Figure 1** – Overall plan*
Park Place Station

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Franklin Avenue 'S' Line Stations
(Park Place Station)

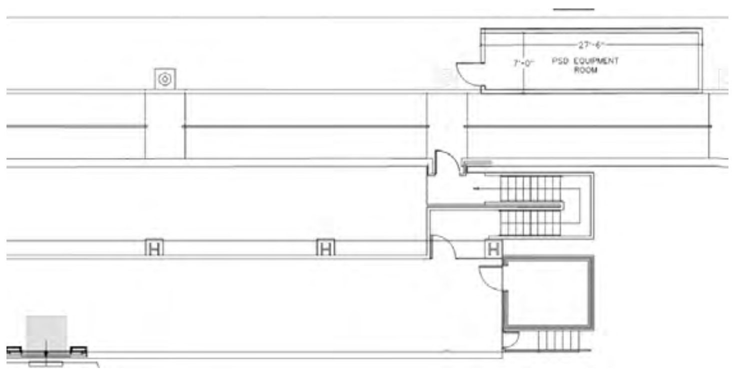

Figure 1 – Equipment Room plan

Platform obstructions within 5' of edge:

- None

Lighting:

Existing lighting: Throughout the platform there is linear florescent lighting parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station

Station Power Capacity Analysis (Normal Service)

Station Name	Park Place
Peak Demand Load from ConEd Report, (kW)	33.6
Apparent Power (kVA)	42.0
Station Peak Demand Load, Max Current, (A)	116.7
Maximum Amount of Doors	8.0
PSD Total Load Including All Miscellaneous Loads, (A)	63.2
Total Load (Station Peak + PSD), (A)	180
Station Service Power Capacity, (A)	600
Service Spare Capacity, (A)	420
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 600A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Park Place
Peak Demand Load from ConEd Report, (kW)	5.6
Apparent Power (kVA)	7.0
Station Peak Demand Load, Max Current, (A)	19.4
Maximum Amount of Doors	8.0
PSD Total Load Including All Miscellaneous Loads, (A)	63.2
Total Load (Station Peak + PSD), (A)	83
Station Service Power Capacity, (A)	600
Service Spare Capacity, (A)	517
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram& field survey, having 600A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service.

Table 2. Power Capacity Analysis

***Figure 3** – General platform view*
Park Place Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $11.3M to install APGs and $12.4M to install PSDs (See Appendix E).

1.04 – MR 142 | Botanic Gardens Station

Summary: *Botanic Gardens Station is feasible for both APGs and PSDs. Platform edge reconstruction would be required to support the requirements of an APG system (see Appendix B). Existing power is adequate.*

Description

The Botanic Gardens Station is a below-grade station with two straight side platforms **(see Figure 1)**. The platform structures are cast-in-place concrete. The platform columns are set 8'-8" from the platform edge. The platform width varies from approximately 8'-0" to 17'-8". Ceiling heights measure no less than 7'-6" throughout.

Full Height PSDs: Full height PSDs will require lateral structural bracing to the station ceiling as well as reconfiguration of existing ceiling-mounted systems to address edge-of-platform requirements of lighting, entrapment prevention sensors, CCTV, and standard NYCT wayfinding signage.

Half Height PSDs (aka APGs)**:** This system is less likely to affect existing lighting and other systems on the ceiling. Depending on the half height PSD design, sensors may be ceiling-mounted or mounted on the APG unit itself. In any case, there will be a CCTV camera over each motorized sliding door which will need to coordination with existing or replacement lighting.

Equipment Room

The equipment room can be located at the edge of the mezzanine (**see Figure 1, Figure 2)**. The proposed room dimensions are 27'-6" x 7'-0".

Track Layout

Tracks are tangent. Thus, we are not expecting that gaps between the platform and train will exacerbate the gap between the train doors and the PSDs. However, per NYCT standards, the Limiting Line of Line Equipment (LLLE) would necessitate the placement of PSDs sufficiently distant to create gaps that would need to be addressed by entrapment prevention measures.

Platform Edge Condition

The platform edges were reconstructed within the past thirty years. From our limited visual inspection and our knowledge of repair strategies used in station rehabilitations over the last thirty years, structural work would at a minimum be required for the installation of an APG system.

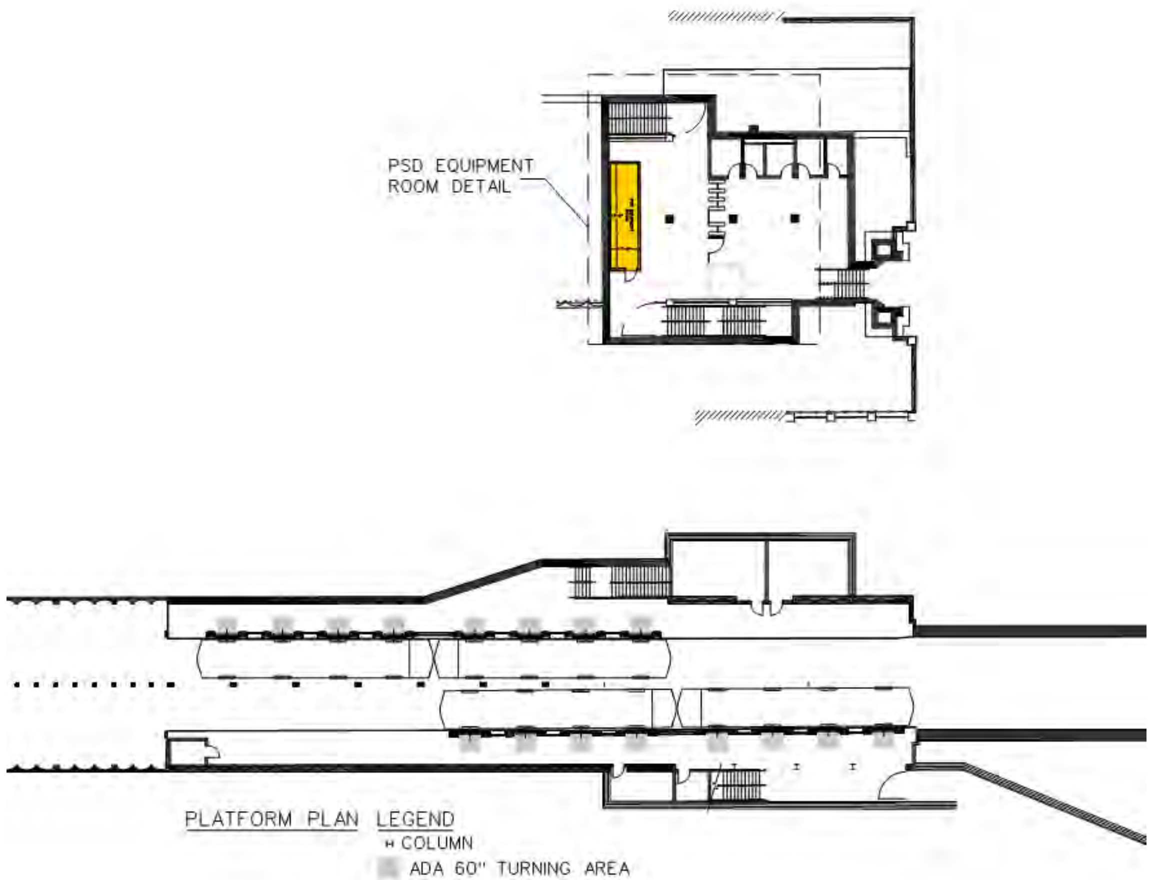

***Figure 1** – Overall station plan*
Botanic Gardens Station

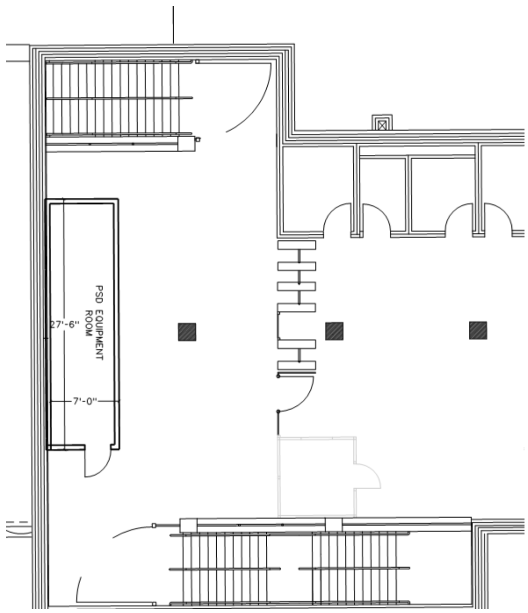

Figure 1 *– Equipment Room plan*

Platform obstructions within 5' of edge:

Southbound Track:

- None

Northbound Track:

- None

Lighting:

Existing lighting: Throughout both platforms there are linear florescent fixtures mounted parallel to the platform edge. Depending on the specific APG/PSD design used, there could be no or minimal alterations to the existing lighting configuration.

Power:

This station has adequate capacity to support the implementation of an APG / PSD system. Please note, a lack of adequate existing power is not considered to be a determining factor of future feasibility. If in the future, a PSD/APG project is to be implemented at this station, and it is determined at that time that an upgrade in power service to the station is required, it would simply mean an increased cost to the project. Below in Tables 1 & 2 please see the Power Capacity Analysis for this station.

Station Power Capacity Analysis (Normal Service)

Station Name	Botanic Gardens
Peak Demand Load from ConEd Report, (kW)	27.2
Apparent Power (kVA)	34.8
Station Peak Demand Load, Max Current, (A)	96.5
Maximum Amount of Doors	16.0
PSD Total Load Including All Miscellaneous Loads, (A)	77.8
Total Load (Station Peak + PSD), (A)	174
Station Service Power Capacity, (A)	500
Service Spare Capacity, (A)	326
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 500A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service.

Table 1. Power Capacity Analysis

Station Power Capacity Analysis (Reserve Service)

Station Name	Botanic Gardens
Peak Demand Load from ConEd Report, (kW)	5.6
Apparent Power (kVA)	7.0
Station Peak Demand Load, Max Current, (A)	19.4
Maximum Amount of Doors	16.0
PSD Total Load Including All Miscellaneous Loads, (A)	77.8
Total Load (Station Peak + PSD), (A)	97
Station Service Power Capacity, (A)	500
Service Spare Capacity, (A)	403
Is Electrical Service Adequate?	**Yes**
Notes	Service rating is based on the 1 line diagram & field survey, having 500A fuses at Service switch. Station has (2) separate meter readings, for each Normal & Reserve service.

Table 2. Power Capacity Analysis

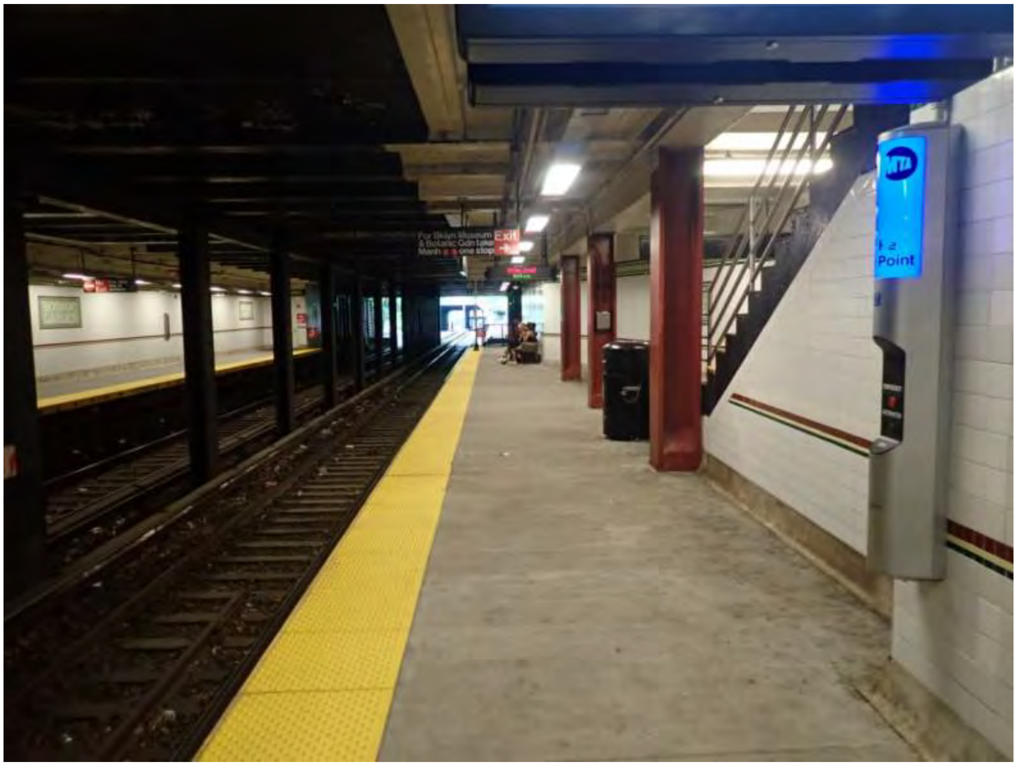

Figure 3 *– General platform view*
Botanic Gardens Station

Historic Restrictions:
None

Rough Order-of-Magnitude Cost Estimate:
The rough order-of-magnitude (ROM) cost estimate is based on a summary of anticipated costs developed through a review of field conditions, analysis of space constraints and existing documentation. It is not based upon an actual conceptual design. The basis of estimate assumptions are listed in the attached ROM estimate. The total cost for this station is estimated to be $14.1M to install APGs and $16.4M to install PSDs (See Appendix E).

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Appendices: Table of Contents

Appendix A

Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0 and Berthing Report)

Issued: 9/15/17

1.0 Executive Summary

This Technology Assessment was first submitted to NYCT as part of the first Line report that recommended the location of the Pilot PSD installation. It is included in the Line reports that follow as an Appendix for reference in the series of Line reports that will make up the System-wide Feasibility Study analyzing the challenges to be met, modifications required, and rough order of magnitude cost associated with the integration of automated fall protection into the existing NYC Transit system. This system-wide study will be performed over the coming months and years.

To quote from our scope of work for this system-wide study:

> ***1.0*** *The study will employ a hierarchical approach to assess the feasibility of installing Platform Screen Doors (PSDs), Automatic Platform Gates (APGs) or Rope Platform Screen Doors (RPSDs) via development of a screening criteria that defines 'fatal flaws' and/or critical cost factors. These screening criteria shall be recorded . . . for future reference.*
>
> ***1.1*** *Feasibility criteria addressed in Tier 1 screening will include the mix of cars classes at a given platform edge and the feasibility of PSD/APG/RPSDs given the mix of car door locations.*
>
> ***1.2*** *For subway stations and platform edges that pass Tier 1 screening, subsequent feasibility criteria for Tier 2 Stations' screening will include the following:*
>
> a. *Column location in relation to the platform edge*
> b. *Platform edge clearance adjacent to stairs and other impediments*
> c. *Impacts to ADA path of travel and boarding areas*
> d. *Conflicts of PSD/APG/RPSDs with Signals cables*
> e. *Sufficient platform width*
> f. *Extreme non-tangent track*
>
> ***1.3*** *For subway stations and platform edges that pass Tier 2 screening, subsequent feasibility criteria for Tier 3 Stations will include the following:*
>
> a. *Structural capacity of platforms to accept PSD/APG/RPSDs*
> b. *Feasibility & location for PSD/APG/RPSDs equipment room*
> c. *Confirmation of adequate power for PSD/APG/RPSDs*
> d. *Preliminary screening for the need to perform computational fluid dynamics (CFD) modeling for a given station due to existing conditions.*
> e. *Determination of communications requirements, availability and cost*
> f. *Determination of gap detection and entrapment avoidance technology requirements*
> g. *Determination of light fixture or other conflicts due to existing conditions*
>
> ***1.4*** *The scope will include field surveys of all stations and platforms that pass Tier 1 screening, as required.*
>
> ***1.5*** *A feasibility report that compiles all findings, including recommended technology(s) and rough order of magnitude estimates for Tier 3 stations will be provided on a Line by Line basis.*

2.0 Technology Overview

Platform screen doors (PSDs) and automatic platform gates (APGs) are permanent glazed barrier systems erected along the edge of a platform. Rope Platform Screen Doors (RPSDs) are horizontal cable barrier systems that raise and lower at the platform edge. These systems and solutions provide numerous benefits to the subway system including increased safety, reduction of track fires, potentially improved operations and

a customer focused user experience. While there are many benefits, there are also challenges including entrapment, berthing and additional complexity to the subway system.

There are common advantages, challenges to overcome and disadvantages to introducing platform edge barrier technologies into an existing subway system that was never designed for such technology. A simple analogy to the challenge of installing these barriers is to look at New York City before cars and after cars. The introduction of cars changed the way the streets were designed. The downtown area has narrow winding streets with tight vehicle lanes, even one way, where cars squeeze through the concrete canyons. Midtown has wide streets and avenues with multiple lanes for driving and parking. Midtown was designed for the technology, where downtown was not. This effort seeks to put a new safety technology into crowded stations designed over 100 years ago for a lower population and less frequency.

Listed below are the common advantages and disadvantages of these systems. The types of systems and their individual Pros and Cons are identified in the following sections of this chapter.

2.0.1 Platform Edge Barrier Systems

Pros

a. Eliminates the possibility of customers being pushed off the platform.
b. Reduces the possibility of suicide. Effectiveness diminishes as the height of the barrier system reduces.
c. A reduction in track fires from less debris being thrown on the tracks. Effectiveness diminishes with lower heights and opacity of barrier system.
d. There will be a significant reduction in illegal track access.

Cons

a. Space constraints, due to layout of station including potential column interferences and platform widths, must be reconciled with the Americans with Disabilities Act (ADA) and Building Code of NY State (BCNYS) requirements.
b. Requires sufficient space for barrier system electronic control equipment and/or a new control room if space is not available in existing station communication room(s).
c. New maintenance requirements of a new electro-mechanical system (most of it can be done from the platform) including cleaning of the trackside glass, cleaning of the gap detection sensors, routine belt replacement, etc.
d. Requires structural capacity to accept selected cantilevered barrier system. Some stations may require remediation work to reinforce the platform edges.
e. Requires sufficient electrical power and sufficient bandwidth for RCC monitoring.
f. Station maintenance from the trackside must be performed through barrier openings.
g. Will increase the time needed for station cleaning.
h. Interference with police radio coverage from antennas on the track wall will require additional study and potentially increase antenna installations.
i. Passengers currently have 100% availability to the subway car doors. When there is a fault in the system or a mechanical breakdown (reportedly rare at other agencies), there will be a reduction in access to the car doors.

j. Grounding requirements include the need to paint columns within arm's reach of the platform barriers with a non-conductive coating, similar to vinyl ester, to reduce stray voltage touch potential.
k. Lighting directly above the platform edge will likely need to be relocated to accommodate structure and overhead gap detection devices.
l. Other cabling/conduit under the platform edge or elsewhere in this area will also need to be relocated.

Photo 1 – Free-standing PSDs at Westminster Station, London, UK.

2.1 Platform Screen Doors (PSDs)

Physical Characteristics

Platform screen doors are tall, vertically glazed barriers that are installed along the platform edge to separate the track way from the platform. Platform screen door systems are modularized and consist of glazed bi-parting doors, glazed fixed panels and glazed emergency exit doors with a common header on top. The header is made of aluminum or steel and houses the electro-mechanical equipment that operates the doors including the motorized drive system, controls and wiring. A single motor controls both leaves of a door opening.

The PSD assembly is typically 8'-0" tall to the top of the header. The bi-parting doors are aligned to the train doors when the car is berthed. There is a berthing tolerance in the sizing of the door opening widths, making the PSD openings wider than the car body doors. This will allow enough clearance between the two sets of doors to maintain ADA clearance requirements should the train not berth accurately.

PSDs may be cantilevered from the platform, hung from structure overhead or span from platform to overhead structure. Due to the variability of existing conditions in the NYCT system, PSDs cantilevered from the platform present the most flexible option.

There may be additional construction above the PSD header to physically separate the track-way from the platform. This is usually the case in new stations where the platform can be air conditioned or air tempered for customer comfort. In the existing NYCT system however, installation of PSDs in below grade stations should be based on design criteria developed from Computation Fluid Dynamics (CFD) modeling addressing temperature rise, ventilation and smoke control. The results may require more or less air movement above or through the PSD barrier.

PSD Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. There is a reduction of piston effect on customers. This may potentially contribute to higher train speeds entering and leaving the stations.
c. There will be a significant reduction in illegal track access.
d. The presence of the doors will allow the customers to queue up at the door locations, potentially reducing dwell time.
e. Depending upon the degree of enclosure there may be a sound attenuation benefit, reducing the sound from the trains.

PSD Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. Each below grade station requires CFD analysis.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing PSD door locations for the lines they will be designed to operate on.

Photo 2 – Automatic Platform Gates at Châtelet Station, Paris, France

2.2 Automatic Platform Gates (APGs)

APG Physical Characteristics

Automatic Platform Gates (APGs) are a lower version of PSDs. They are typically 6' high, but can be as low as 4'-6". They operate in the same way as PSDs. APGs are often used instead of PSDs at exterior stations, when the arrangement of the station or airflow requirements do not allow for an 8' tall PSD or the platform will not sustain the higher structural forces of a PSD.

APG systems are an arrangement of shorter glazed bi-parting doors with pylons on each side to house the motors and accept the doors as they operate. There are also fixed glazed panels and emergency egress doors, similar to PSDs. There are no multiple mounting options and are only secured on top of the platform. APGs generally weigh less because of their height.

There are twice as many motors on APGs than PSDs for the same amount of doors. All wiring is done under the platform edge on the track side of the doors, meaning additional core drilling through the platform.

APG Pros

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs except as may be affected by their shorter height.
c. Minimal impact on air movement and ventilation. With additional experience CFD analysis may not be required at all underground stations.

APG Cons

a. Refer to the Platform Edge Barrier Pros/Cons for additional bullet points.
b. In most respects, similar to PSDs.
c. Door locations are fixed, requiring a captive fleet of cars and consists.
d. Future subway car purchases will be required to maintain the existing APG door locations for the lines they will be designed to operate on.
e. Maintenance issues unique to APGs:
    - Double the amount of motors as PSDs (each motor operating a single leaf).
    - APGs only come with belt drive motors, which do not last as long as the screw drives available on PSDs.
    - The electrical load of the doors will increase with APGs, though the motor sizes are slightly smaller because the weight of the doors is less.
    - Cabling to connect the doors is located below the platform on the track side which may require a track outage for maintenance; additional core drills into the platform for the wiring connections; and possibly space constraints at some stations.

Photo 3 – Roped Platform Screen Doors, (closed in left image, open in right image)

2.3 Roped Platform Screen Doors (RPSDs)

RPSD Physical Characteristics

Roped Platform Screen Doors (RPSDs) systems consist of two vertically lifted panels made up of horizontal cables spanning between vertical pilasters which house the vertical structure, lifting motors and mechanisms. The vertical pilasters are spaced at 20 to 30 feet along the platform edge and when the doors are open (up) the majority of the platform edge is open to accommodate multiple doors between each pair of pilasters. With a pair of motors in each pilaster and lighter door panels there are fewer motors and likely reduced electrical loads.

Currently these systems have had limited use on rail systems in Korea and Japan. They were not included in the International Research trip and report conducted in 2016 by NYCT and STV (NYCT Contract #: C-32514, Final Report Submission: September 21, 2016).

RPSD Pros

a. No impact on air movement and ventilation, i.e., CFD analysis not required at underground stations.
b. Can accommodate multiple doors locations, car classes and consists.
c. The electrical load of the doors is lower due to reduced number of motors and weight.
d. There is no glass to clean.

RPSD Cons

a. Vertically opening RPSDs are not synchronized with bi-parting car doors. Passengers may be more likely to be caught under closing RPSDs thus requiring sensors to stop RPSDs until space below is clear, possibly resulting in delays. This may also increase the likelihood of entrapment between RSPDs and car doors.
b. Due to the sequential raising of the two RPSD panels, fingers, hands, or other objects may be caught in the roped panels as they rise.
c. Subway car doors are horizontally bi-parting, while RPSDs open vertically, potentially creating boarding and alighting hazards that are not present in bi-parting systems.
d. RPSDs do not provide pre-boarding cues to door locations.
e. Concern is raised regarding hanging and swinging from the raised roped panels
f. The horizontal cables are easily climbed when in the closed position.
g. Very limited control of objects that may be thrown on tracks.
h. Requires a minimum of approximately 10 feet clear vertical height above platform edge.
i. Does not significantly reduce or eliminate potential for debris thrown onto the tracks.
j. Does not prevent dropped items from falling on the tracks.

Based upon limited information from South Korea it should be noted that these were removed and replaced with APGs in one instance. We have not yet determined why.

While RPSDs can accommodate multiple car classes, they do not fulfill many of the original design criteria for this project and introduce new hazards that appear problematic.

PSDs and APGs have been installed in most non-American subway systems around the world with little issue. PSDs and APGs will force NYC Transit into using captive fleets on each line where they are installed. While this may be seen as a drawback to the design of new cars in the future, it will simplify the car classes and potentially, operations.

2.4 Key Factors to Technology Selection

In order to recommend a system for trial installation a number of key factors must be assessed. These include:

- Operational impact

- Adaptability to accommodate multiple car classes and train consists
- Effect on existing platform lighting often located above the platform edge
- Station ventilation
- Police Radio antennas (leaky coaxial cable)
- Conflict with Signal cables
- Electrical load
- Degree of fall protection
- Visual impact

We have summarized and graded these factors in the following matrix. The grading is somewhat subjective in that the value placed on each factor is equal. APGs appear to be the best choice for a pilot installation. However, we recommend thorough post-pilot analysis before a large system-wide roll out is undertaken.

Refer to the table on the next page.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Assessment of Platform Screen Door Technologies					
Assessment Factors		**PSDs**	**APGs**	**RPSDs**	**Grading system**
General Factors	**Specific Subfactors**				
1. Safety - What are the relative benefits of this technology to public safety?					0 - 5 (with 5 highest benefit)
	Protection to the public	5	4	1	higher the number the better
2. Capital Cost - What is the anticipated relative installation cost of this technology?					0 - 5 (with 5 lowest cost)
	Cost of technology itself	2	3	3	higher the number the better
	Cost of impact to existing station systems	2	3	2	***RPSD's have not been priced**
3. O&M Cost - What is the likely relative operations and maintencne cost of this technology?					0 - 5 (with 5 lowest cost)
	Number of motors/elements requiring service	3	2	4	higher the number the better
	Ease of cleaning glass	1	2	5	
	Ease/number of sensors requiring maintenance/cleaning	3	3	3	
4. Operations - What is the impact of the technology on current operations protocols?					0 - 5 (with 5 lowest impact)
	Extent of changes in protocol for train operations	1	4	1	higher the number the better
	Extent of changes to maintenance protocols	1	1	1	
5. Risks - What are the foreseeable risks in safety and operations of this technology?					0 - 5 (with 5 lowest risk)
	Risks to conductors	1	5	1	higher the number the better
	Risks of entrapment	3	3	1	
Raw Score		22.00	30.00	22.00	
Weighting of the Factor No.	**Weight of Each Factor**				
1.	25.0%				
2.	20.0%				
3.	20.0%				
4.	20.0%				
5.	15.0%				
Weighted Score		4.30	5.05	4.20	**Highest value is best**

Technology	Comments
Platform Screen Doors (PSDs) (> 8' in height)	Recommended for new underground stations; benefits air tempering and smoke control systems; not recommended for existing stations as impact to existing systems, particularly station ventilation, are too high
Automated Platform Gates (APGs) (< 6' in height)	Recommended for existing underground, open cut, and elevated stations where feasible; provides most of the benefits of PSDs with marginally lower cost and fewer impacts to existing systems and existing operating procudures
Roped Platform Screen Doors (RPSDs) (full height vertical lift rope screens)	Guillotine operation is not intuitive; risk of head injury during closing or pinching of fingers & hands; vertical lift requires additional height (10"-0" min.); technology has very limited use worldwide; horizontal cables encourage climbing

Figure 1 - Platform door technologies; comparative analysis. Note: RPSD costs are "order of magnitude" based on costs of similar systems.

3.0 Operations Issues

3.1 Berthing Control Systems

In order for the platform door system to function, the doors must only open when a train is present and accepting/discharging passengers. The majority of PSD/APG suppliers do not detect interface directly with the train but interface to an ATO (Automatic Train Operating) system or a 3rd party berthing controller. The berthing controller (or ATO system) must:

- Transmit door open/closed commands from the train to the wayside
- Verify that the train is stopped
- Verify that the train doors are aligned with the platform doors
- Monitor platform door closure, to avoid movement of train when a door is open
- Monitor for individuals trapped between the platform doors and train (required if the gap is large enough to be a concern)

Berthing controllers can be procured that integrate via CBTC, via a new dedicated onboard/wayside loop, or that are installed only on the wayside and monitor the train using sensors. A wayside only system is proposed for the pilot. This avoids modifications to all the applicable vehicles for a one station pilot, while still providing NYCT with an understanding of how well platform doors will work in NY.

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If, prior to this pilot, NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, initially investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	**Dedicated Loop**	**Wayside Only**
CBTC Software Change	Yes	No	No
Equipment on trackbed	Maybe	Probably	Maybe
Requires vehicle work	Yes	Yes	No
New wayside sensors for each platform (excluding entrapment)	0	0	8
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure. (see section 3.2)

3.2 Gap Detection Systems

Entrapment distance refers to the space between the track side of the platform door and the car door. The project team visited transit agencies in Europe and Asia where platform doors had been installed. Each agency had different train types, wayside clearance diagrams, station entering speeds and vehicle dynamic envelopes. They all differ from NYC Transit's operating criteria. Because of the conservative criteria used to establish NYC Transit vehicles' limiting line of car clearance, the entrapment distance is comparatively large and may cause life safety conditions where a person could be trapped between the train doors and PSDs.

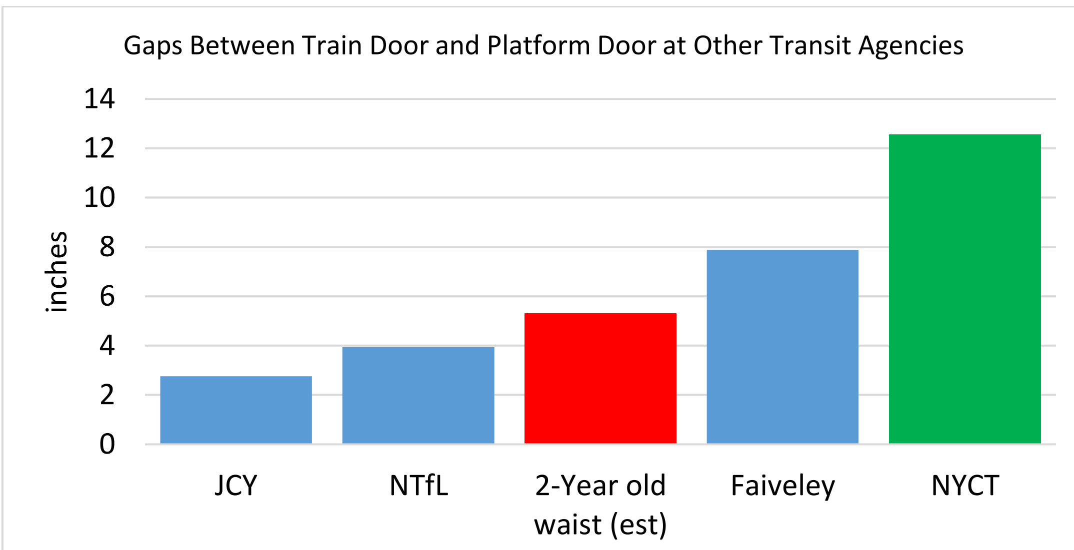


Figure 2 - Comparative gaps in various transit systems - JCY- Shanghai, NTfL - London, Faiveley - Paris

Images of Other Agency PSD Gaps

Figure 3 - Paris: no entrapment detection

Figure 4 - Paris: no entrapment detection

Figure 5 - France ATO: no entrapment detection

Figure 6 - Paris, on curve: used 3 2D scanning lasers per door

Figure 7 - Shanghai: End of platform light detection

Figure 8 - Seoul: Platform observers

Currently, NYCT has a gap at least double the recommended gap. Per the car equipment drawings for R160 (13017-03502b, sht 5 of 5, Rev b), the vehicle door is 55.4" from track centerline. Per NYCT drawing ML-CT-BT (Rev 2), the Limiting Line of Line Equipment (LLLE) ranges from 65.5" to 70.9" (depending on height of measurement) from track centerline. This provides an area of entrapment on the order of 10" to 15.5", which is greater than the recommended gap. The recommended gap is based on the size of the smallest human body which could possibly be entering the train – a toddler.

LLLE mark	Lateral distance from track CL	Height above platform	Gap between LLLE and vehicle door*
C	65.5"	0"	10.07"
D	66.8125"	27.375"	11.3825"
E	70.875"	73"	15.445"

* This gap dimension does not include any additional movement due to vehicle or track wear.

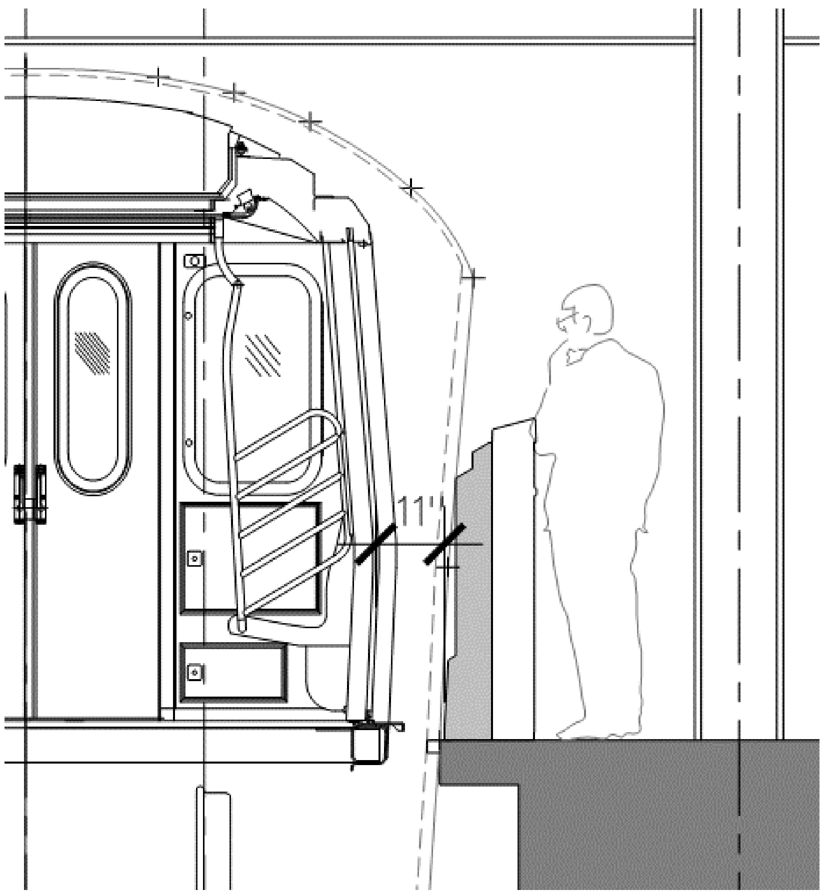


Figure 9 – Section - NYCT B-division showing Limiting LIne of Line Equipment and gap created between platform and train door

Based on our research, there are three alternative solutions to this problem. The first is gap detection where laser sensors are installed above the gap to detect obstructions. Laser detection devices need to be cleaned at least every 6 months. False detection from thrown objects, swirling newspapers, birds or lack of cleaning may create false positives and lead to train delays. Below is a calculation of reliability for detectors.

Entrapment Detection Reliability

0.02%	false detection rate per sensor per departure (per ClearSy discussion)
24	sensors per platform
0.48%	false detection rate per departure = 1 - (1- 0.0002)^24
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
70%	false detection rate for 1 platform over one day = 1 - (1- 0.0048)^249

	Impact per station
2	or fewer false detections on most days (binomial distribution 50%)
5	or fewer false detections on 95% of days (binomial distribution 95%)
71	or fewer false detections per month (on average)

Entrapment Detection+ Wayside Berthing Reliability

0.02%	false detection rate per sensor per departure (assuming same failure rate as entrapment)
32	sensors per platform
0.64%	false detection rate per departure = 1 - (1- 0.0002)^32
249	departures per day per platform (based on schedule, counted 249-318 departures/day)
80%	false detection rate for 1 platform over one day = 1 - (1- 0.0064)^249

	Impact per station
3	or fewer false detections on most days (binomial distribution 50%)
6	or fewer false detections on 95% of days (binomial distribution 95%)
95	or fewer false detections per month (on average)

Impact of Wayside Berthing System

24	more false detections per month
34%	more false detections per month

The second option is to modify the parameters that define the limiting line of car clearance that would effectively reduce the gap by moving the PSDs closer to the platform edge. This can be done by reducing the assumptions of one suspension failing and/or reducing the entering speed of the cars so that there is less rolling of the car. RATP noted that they recalculated vehicle clearances for platform screen door clearances in order to reduce the gap between the train and platform doors.

They did this by removing some of the 'excessive' criteria items due to higher speeds and multiple tolerances that were unlikely to occur concurrently.

A third recommendation would be for NYCT to have the manufacturer install rubber "bumpers" on the edge of each platform door, such that most of the gap is filled by the flexible rubber edge. This solution was employed on the Paris Metro (see photo below)

Figure 10 - Rubber bumper on leading edge of platform APG door at bottom of photo

The dynamic envelope we have been given by NYC Transit MOW restricts our ability to address entrapment with rubber bumper extensions on the leading edges of the bi-parting PSDs. To reduce the risk of entrapment enough to consider elimination of the gap detection system, we would have to extend approximately 6" into the line equipment envelope. This would leave a 5" gap between the platform and car doors allowing approximately 2" of lateral train movement before any contact is made with a moving train. While elastomeric/rubberized extensions may be effective on straight track, a combination of gap detection, CCTV and rubber extensions may be required on non-tangent platform edges. These extensions are an option that may greatly reduce the need for gap sensors and would reduce the corresponding failures and related delays. This would only be possible if the restrictions of the NYC Transit MOW dynamic envelope were relaxed.

Recommendation – Gap Detection

STV is recommending that entrapment detection be used for the pilot, and that NYCT make long-term plans to reduce the gap to less than 5” by:

- Creating a new Limiting Line of Line Equipment (LLLE) for PSD platforms, allowing a closer alignment of the train car with the platform edge.
- On new vehicle procurements, reduce the distance between the Limiting Line of Car Clearance (LLCC) and the exterior face of the vehicle door

Due to the entrapment system being fail-safe and the large number of doors to be equipped, this is expected to result in 1 to 3 departure delays per 32-door platform per day. This will require a bypass procedure to be included in the final design of the platform doors. For the pilot, install entrapment detection and camera assisted visual verification at every door.

If NYCT decides to proceed past the pilot, a plan should be put into place to modify the vehicle and wayside clearance to geometrically prevent entrapment.

3.3 Train Operations

There will be significant differences in operating procedures between the PSD, APG and RPSD systems.

With PSD and RPSD, train operators will no longer be able to open their window and visually observe the platform edge before leaving the station. They may still check monitors on the platform after first being informed by the berthing system that doors are closed and gaps are clear.

By contrast, an APG system designed to a height below the bottom of the conductor’s window will permit operations to remain unchanged because the conductor will continue to be able to lean out of the window and will have full visibility forward and aft.

For the purpose of this pilot, where only one out of 24 stations on the line will have the installation, consistency of operation is essential. The APG system, designed for a height to match the bottom of the conductor’s window, is therefore recommended.

For any platform doors system, train crew will still rely on the berthing system to signal that the platform doors are closed, that the gap is clear, and that the train can safely leave the station.

The new operating procedure steps are identified below as **<u>bold/underline</u>**:

- Train side door operation is by Master Door Controller (MDC) key and zone (front and rear) controlled.
- Side door opening operation is initiated when the Conductor (C/R) confirms that he/she is in front of the Conductor Board located along the platform at the appropriate location for the length of train in operation. The Train Operator has activated the Door Enable system (except on R32, R62 and R62A car classes), granting permission to the conductor to open the train side doors.

- **In parallel, the wayside berthing system will detect the arrival of the train. Once the train is stopped in the correct location, the PSD/APG will receive Door Enable. Doors will not yet open.**
- The C/R turns the MDC key to the "ON" position and depresses the left and right side Door Open pushbuttons, transmitting open commands to the train side doors. Train operator and conductor indication is withheld.
- **When the wayside berthing system detects that the train side doors have started to open, the PSD/APG are opened.**
- The C/R leaves the train side doors open for at least 10 seconds to afford customers sufficient time to board and alight.
- Closing is initiated by the C/R, depressing the Close pushbutton in the rear zone, followed by the Close pushbutton in the front zone.
- **When the wayside berthing system detects that the train side doors have started to close, the PSD/APG are commanded closed.**
- **When all PSD/APG are closed, the 'PSD Closed and Locked' (outside C/R and Train Operator locations) are illuminated.**
- **C/R verifies that 'PSD Closed and Locked' indication is present.**
- When all train side doors are closed and locked, C/R indication is established. T/O indication is established when the C/R turns the MDC key to the RUN position.
- **Train Operator verifies that 'PSD Closed and Locked' indication is present.**
- After the train moves, the C/R observes the platform, while the train is moving, for a distance of 75 feet. During this time he/she observe the front of train, then the rear, then the front and then closes his/her cab window.
- All passenger car side doors **and PSD/APG doors** are equipped with door obstruction sensing systems that conform to NYCT requirements for flexible and rigid object detection. On newer car fleets, local recycle and partial open features are present.
- Defective car side doors **and PSD/APG doors** may be mechanically and electrically locked out via key activation on a per panel basis. The cutting out of both car side doors in one door opening will result in a train's removal from service.
- Terminal operation is provided to leave car side doors open at the end of a run. Single panel operation **of both car side doors and PSD/APG doors** may be crew activated via the Crew Key Switch. Future provisions for dual panel opening via the Crew Key Switch are to be incorporated in conjunction with ADA requirements.
- If a train, in Two-Person Crew Operation, stops short of the appropriate station car stop sign the Train Operator must pull up for a proper station stop.
- If the train stops beyond the station limits, the C/R must apply the Emergency brakes by pulling the Emergency handle located in the cab.

- The T/O must immediately notify the RCC giving the reason for the overrun and the train crew will then be governed by RCC instructions.

4.0 Electrical Power Analysis

Below is a summary load analysis for the three Canarsie line stations, based on numbers provided for peak demand load for the three different models for which information is available.

For the purpose of assessing whether the stations' electrical service is adequate to accept the PSD & related loads, we have used the PSD system with the highest KVA load of 52.6 KVA (worst case). The PSD system 3 (Faeveley Modal APG) is therefore selected. All load numbers include power requirement for simultaneous operation of 80 doors per station. Additionally, for the Union Square Station, we have also added the load of a new escalator (as provided by NYCT), and for 1st Ave station, we have added the load of new elevators and related items (as provided by NYCT).

System Load Analysis	PSD System 1	PSD System 2	PSD System 3
	Based on Horton Info.	**Faiveley (Model ES2)**	**Faiveley (Model APG)**
Nominal Power (door sliding):	9.6 KW	8.1 KVA	12.1 KVA
Acceleration (See Note 1)	"Max. Sustained Power": 30.24 KW = 105A	"Acceleration": 32.3 KVA = 90A	"Acceleration": 52.6 KVA = 146A
Misc. Load related to PSD: entrapment, Comm. cabinet, berthing, AC, UPS, etc.	12 KW = 42A (0.8 PF @ 208V, 3Phase)	12 KW = 42A	12 KW = 42A
Total PSD-related Load:	105 + 42 = 147A	90 + 42 = 132A	**146 + 42 = 188A**

Note 1. The KVA load of PSD System 3 during acceleration is used as worst case load in this summary.

Appendix A – Tier 2-3 Technology Assessment (Summary of Sections 2.0 through 5.0)

Station Capacity Analysis	3rd Ave.	6th Ave.	14 St / Union Square	1st Ave.
Peak Demand Load: (last 12 months)	43 KW = 151A	72.6 KW = 252A	56 KW = 193A	38 KW = 132A
Escalator Load (See note)	N/A	N/A	200A	NA
Elevator Load (See note)	NA	NA	NA	500A
NEW Load on Station Electrical System:	188	188	200+188	500+188
Total Load	339A	440A	581A	820A
Station's Service Capacity	400A	600A	800A	800A
Notes	Elect. Service is adequate.* Service CB's to be upgraded from 300A to 400A. ConEd to rule if street feeders need to be upgraded once the Authority submits the final new loads. *400A service capacity with 339A total load leaves only 18% spare/contingency. This has been discussed with NYCT CPM and determined to be sufficient.	Elect. Service is adequate	Elec. Service is adequate	The proposed new elect. service is not adequate as currently designed under contract P-36437. The new service request will need to be revisited should these combined projects move forward.

5.0 Code Considerations

5.1 ADA – Accessible Path of Travel

Per the ADA code, there must be an accessible path of travel on the platform from one door of each train to the elevator which serves as the exit path. An accessible path involves three critical steps:

1. Achieving proper gaps between the train and the platform.
2. Providing an adequate landing on the platform to serve as a turning space in the event that there is an obstruction opposite the train door
3. Providing a pathway along the platform to the elevator. The pathway must comply with all horizontal and turning dimensions.

Accessible Door

See below excerpt from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

Subpart C-Rapid Rail Vehicles and Systems
§1192.51 General.
(c) Existing vehicles which are retrofitted to comply with the "one-car-per-train rule" of 49 CFR 37.93 shall comply with §§1192.55, 1192.57(b), 1192.59 and shall have, in new and key stations, at least one door complying with §1192.53(a)(1), (b) and (d).

Permitted Gaps

See below except from ADAAG Subpart C – Rapid Rail Vehicle and Systems:

§1192.53 Doorways.
(2) Exception. New vehicles operating in existing stations may have a floor height within plus or minus 1-1/2 inches of the platform height. At key stations, the horizontal gap between at least one door of each such vehicle and the platform shall be no greater than 3 inches.

Note: All NYCT stations being considered under this study are “existing” as defined by code. All the rolling stock is also to be considered “existing” under the code.

Throughout the system the Authority has interpreted ADA code as requiring an accessible entry at the two doors on either side of the conductor of every train. The conductor is normally placed at the center of each train. This interpretation covers all existing station platforms which undergo renovations.

Wheelchair Landings

When boarding or alighting from a train, a landing zone is established by ADA, similar to the landing in front of an elevator door. The most conservative interpretation is to require a 60” radius for turning (ADAAG 304.3.1). Alternatively, a T-shaped turning zone may be used requiring only 36” of space when exiting the train door (ADAAG 304.3.2). However, ADAAG 304.2 would suggest that the

change of elevation from the train floor to the platform must be outside the turning zone, resulting in the T-shaped space being entirely on the platform.

Obstructions to these required zones on existing platforms include columns, stair walls (ascending stairs) and stair curbs and railings (descending stairs), and miscellaneous utility rooms.

Turning Space

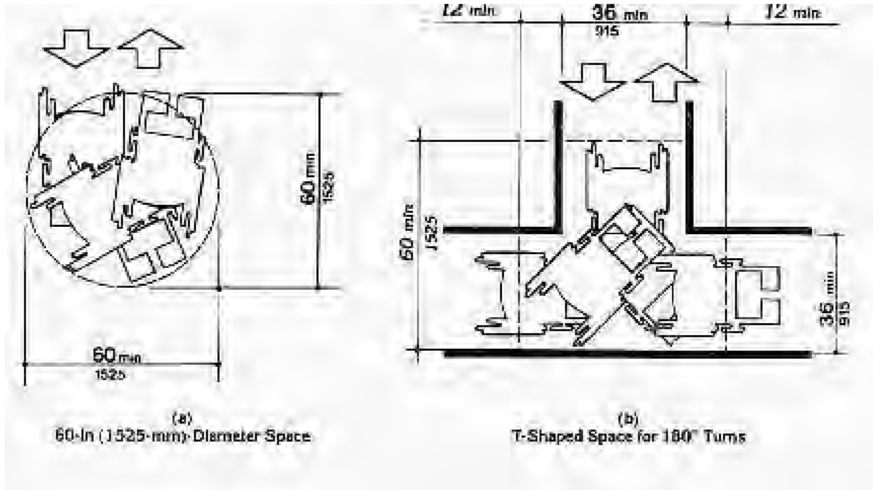
304 Turning Space
304.1 General. Turning space shall comply with 304.
304.2 Floor or Ground Surfaces. Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
EXCEPTION: Slopes not steeper than 1:48 shall be permitted.

Advisory 304.2 Floor or Ground Surface Exception. As used in this section, the phrase "changes in level" refers to surfaces with slopes and to surfaces with abrupt rise exceeding that permitted in Section 303.3. Such changes in level are prohibited in required clear floor and ground spaces, turning spaces, and in similar spaces where people using wheelchairs and other mobility devices must park their mobility aids such as in wheelchair spaces, or maneuver to use elements such as at doors, fixtures, and telephones. The exception permits slopes not steeper than 1:48.

304.3 Size. Turning space shall comply with 304.3.1 or 304.3.2.

304.3.1 Circular Space. The turning space shall be a space of 60 inches (1525 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306.

304.3.2 T-Shaped Space. The turning space shall be a T-shaped space within a 60 inch (1525 mm) square minimum with arms and base 36 inches (915 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or one arm.



Accessible path of travel along platform

Once a wheelchair passenger has passed over the gap, and has turned to travel along the platform to the exit point, the path of travel must have a width of 36" which may be constricted to 32" at a single point.

4.2.1 Wheelchair Passage Width*
The minimum clear width for single wheelchair passage shall be 32 in (815 mm) at a point and 36 in (915 mm) continuously (see Fig. 1 and 24(e))

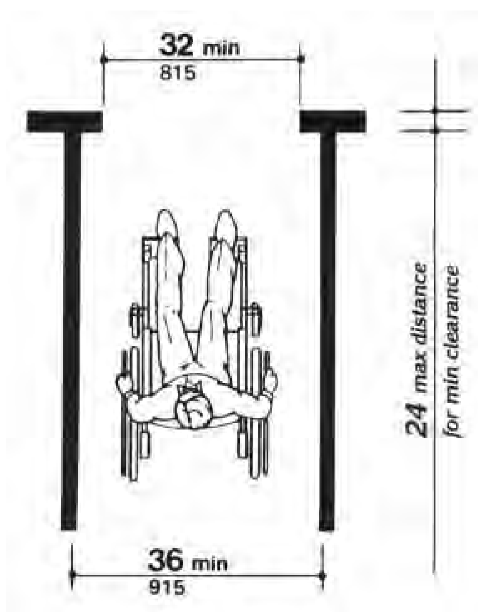


Figure 1
Minimum Clear Width for Single Wheelchair

ADA Summary

The station platforms in the entire system are defined as "existing"; hence the application of the law is often left to interpretation of the code official when it comes to incremental capital improvements to a non-compliant facility. In meetings with NYCT ADA code officials, our team came to understand the following specific application of ADA law to the NYCT system:

Columns, walls, and stairs present obstructions to disabled passengers wishing to board and alight from trains. Per direction of NYCT ADA Code Chief, these passengers must board the train at 90 degrees, and therefore must be able to execute a 90 degree turn if constrained by an obstruction near the platform edge. The applicable rule from the ADA code calls for a 60" turning radius in which to make this turn. (the "T" shape turning diagram is also applicable).

Per direction of NYCT ADA Code Chief, applicability of these standards falls into two distinct categories: the two ADA-designated doors flanking the conductor station; and the remaining 30 doors of the train. For all the doors in both categories, the alteration cannot make a dimensionally compliant condition into a non-compliant condition. For the ADA doors, if the existing condition is non-compliant, the alteration cannot make the existing clearance space more constrained than the existing. For the remaining doors, if the existing condition is non-compliant, the alteration can maintain and further constrain the non-compliant dimensions. There is no requirement to make the gap at the 30 doors compliant.

Beyond the constraints noted in the above paragraph, the NYCT ADA Code Chief noted that if a stair must be reconstructed in a new location, ADA regulations consider it an "alteration to the path of travel", requiring the construction of a fully accessible path from platform to street, i.e. new elevators, unless they are proven to be technically infeasible.

Regarding movement along the platform (parallel to platform edge), the platform edge barrier cannot preclude ADA movement where it currently exists. This is applicable even if a second parallel route exists on the other side of the platform. (An existing 32" point of constraint between the edge of platform and a column is considered a compliant passageway, even if it is less than optimal.)

ADA law requires that 20% of capital budget be directed toward ADA enhancements. Decisions on these enhancements shall be as directed by the NYCT Chief of ADA compliance.

5.2 New York State Code Considerations

By New York State law, NYCT is governed by the NYS Building Code. The specific code for existing buildings is the NYS Existing Building Code. The installation of a new wall with new doors will fall into the category of Alteration Level 2 per the NYS Existing Building Code, Section 504.

Section 504 - Alteration – Level 2
504.1 Scope
Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
504.2 Application
Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

Section 701 – General
701.2 Conformance
An existing building or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Section 704 - Means of Egress
704.1 General
Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.

Section 1020 – Corridors (New Building Code)
1020.2 Width and Capacity
The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.2.

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facilities not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in occupancies where patients receive outpatient medical care that causes the patient to be incapable of self-preservation	72
Group I-2 in areas where required for bed movement	96

Section 705 – Accessibility
705.1.13 Extent of application
An alteration of an existing element, space, or area of a facility shall not impose a requirement for a greater accessibility than that which would be required for new construction. Alterations shall not reduce or have the effect of reducing accessibility of a facility or portion of a facility.

Section 809 – Mechanical
809.1 Reconfigured or converted spaces
All reconfigured spaces intended for occupancy and all spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

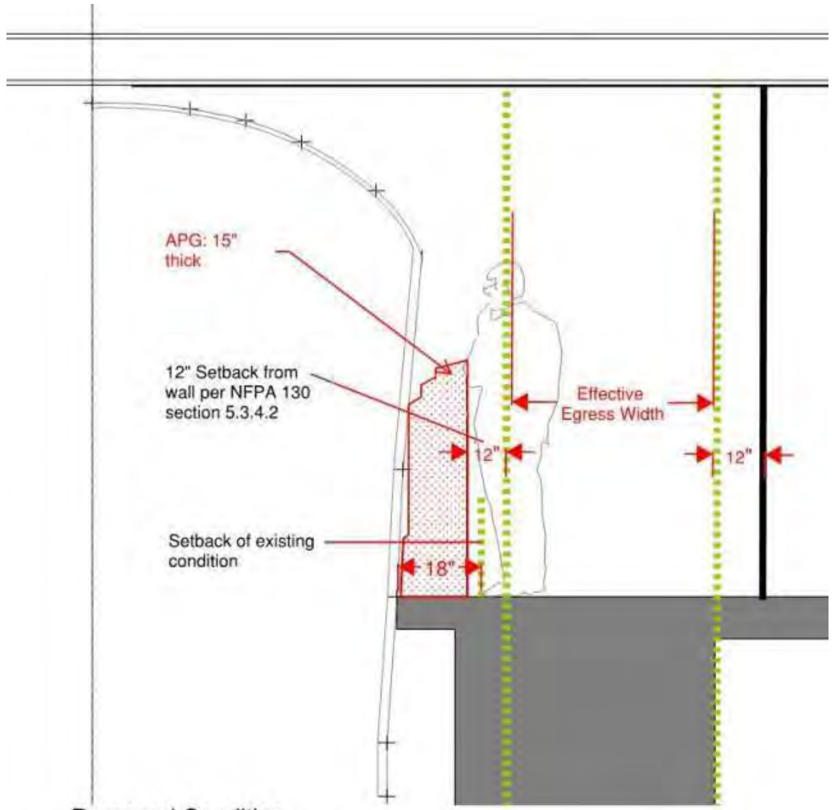
5.3 NFPA-130 (National Fire Protection Association 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems)

Since the NYS Building Code does not specifically address Transit Stations, the NFPA-130 code serves to supplement the building code.

5.3.4 Platforms, Corridors, and Ramps.*

5.3.4.1 A minimum clear width of 1120 mm (44 in.) shall be provided along all platforms, corridors, and ramps serving as means of egress.*

5.3.4.2 In computing the means of egress capacity available on platforms, corridors, and ramps, 300 mm (12 in.) shall be deducted at each sidewall, and 450 mm (18 in.) shall be deducted at platform edges that are open to the trainway.



Proposed Condition
Platform edge at stair indicating effective passageway width between wall and proposed platform doors per NFPA 130

NFPA 130 can be used as a guide to the function of existing platforms as illustrated above.

5.4 General Summary of Code Issues

In the congested physical environment of the NYCT station platforms, the introduction of platform doors will further constrain numerous existing pinch points. Most of these situations are existing non-compliant code violations, built in the distant past prior to enactment of the code. However, the introduction of the platform doors, with their 15" of thickness, will reduce certain already tight clearances to dimensions below code tolerances, in some locations.

However, the situation must be evaluated in its totality. Pinch points at one side of the platform are often balanced by broad open areas on the other side of the platform such that the aggregate egress path to an exit is sufficient. Since this proposed alteration will not comply with the prescriptive code regulations, an egress analysis will be required in order to prove compliance with the intent of the code.

The installation of these platform edge barriers will constitute an Alteration Level 2. Many of the prescriptive requirements of the building code are unattainable in the existing transit station environment, requiring the processing of a variance from the NYS Existing Building Code. This variance could reference NFPA 130,

utilizing a timed analysis egress calculation, demonstrating the feasibility of egress from the platform within prescribed timeframes. The goal will be to prove that the existing non-compliant condition will not be made worse by the new construction.

ADA accessibility does not follow the above-stated logic; it cannot be looked at in its totality. Access at specific points must be provided, otherwise the facility will be non-compliant. Where the ADA-designated train doors fall adjacent to an obstruction, significant reconstruction may be required.

The wide variability of conditions that may be encountered required a detailed study of these conditions during feasibility surveys to determine which platforms / stations would best meet code requirements. After station selection a full egress analysis will serve as the basis of a variance request for approval by the State.

End of Appendix

Berthing Report

Appendix A (Continued)

Berthing Control System Comparison

Revision 5 – 2017-07-14

The purpose of this document is to summarize the functional needs of the berthing control system, describe what agencies and suppliers currently propose and to make an initial recommendation.

Table of Contents

Summary

Three main methods of berthing communication were considered. For a pilot, **a wayside only system is proposed as being most cost effective**.

If prior to this pilot NYCT decides it will install systems at more than 10 stations, and Siemens does not identify any showstoppers, investing in the CBTC upgrades becomes more cost effective.

Pros/Cons

	CBTC	Dedicated Loop	Wayside Only
CBTC Software Change	Yes	No	No
Work within Gauge	Maybe	Probably	Maybe
Vehicle units to touch	69	69	0
New wayside sensors for each platform (excluding entrapment)	0	0	8 (front, rear, 2 doors)
New onboard processors	No	Yes	No
Onboard connections to door circuits	Yes	Yes	No
Rough Reliability Estimate*	Good reliability	Good reliability	Not as good

* The reliability of the berthing system for the pilot is not a large consideration, as it is dwarfed by the reliability concerns of the entrapment sensors. ClearSy noted a 0.02% false positive rate per door with entrapment sensing, or 0.48% failure per departure. With the worst-case wayside only berthing system, this raises to 0.64% failure per departure.

Rough Order of Magnitude Cost Estimate

	Unit Cost	CBTC		Dedicated loop		Wayside only	
		Qty.	subtotal	Qty.	subtotal	Qty.	subtotal
Siemens software*	$2,000,000	1	$2,000,000	0	$0	0	$0
- Onboard updates		138	$611,912	138	$845,028	0	$0
- Wayside updates	$1,000	50	$50,000	0	$0	0	$0
Wayside design			$200,000		$300,000		$500,000
Wayside laser	$14,500	0	$0	0	$0	16	$232,000
Wayside loop	$5,000	0	$0	4	$20,000	0	$0
Onboard design			$100,000		$100,000		$0
Onboard devices	$15,000	0	$0	138	$2,070,000	0	$0
Total (1 station)			**$2,961,912**		**$3,335,028**		**$732,000**
Recurring costs	(approx.)						
Per Station			$0		$20,000		$232,000
For 50 stations	(approx.)		**$2,961,912**		**$4,335,028**		**$12,332,000**

1. Yellow numbers are placeholder, pending Siemens input.
2. Only costs impacted by berthing selection are listed

DETAILS

General Concept of a PSD/ASG Station Stop

A Berthing Control System performs the following functions during a normal station stop:

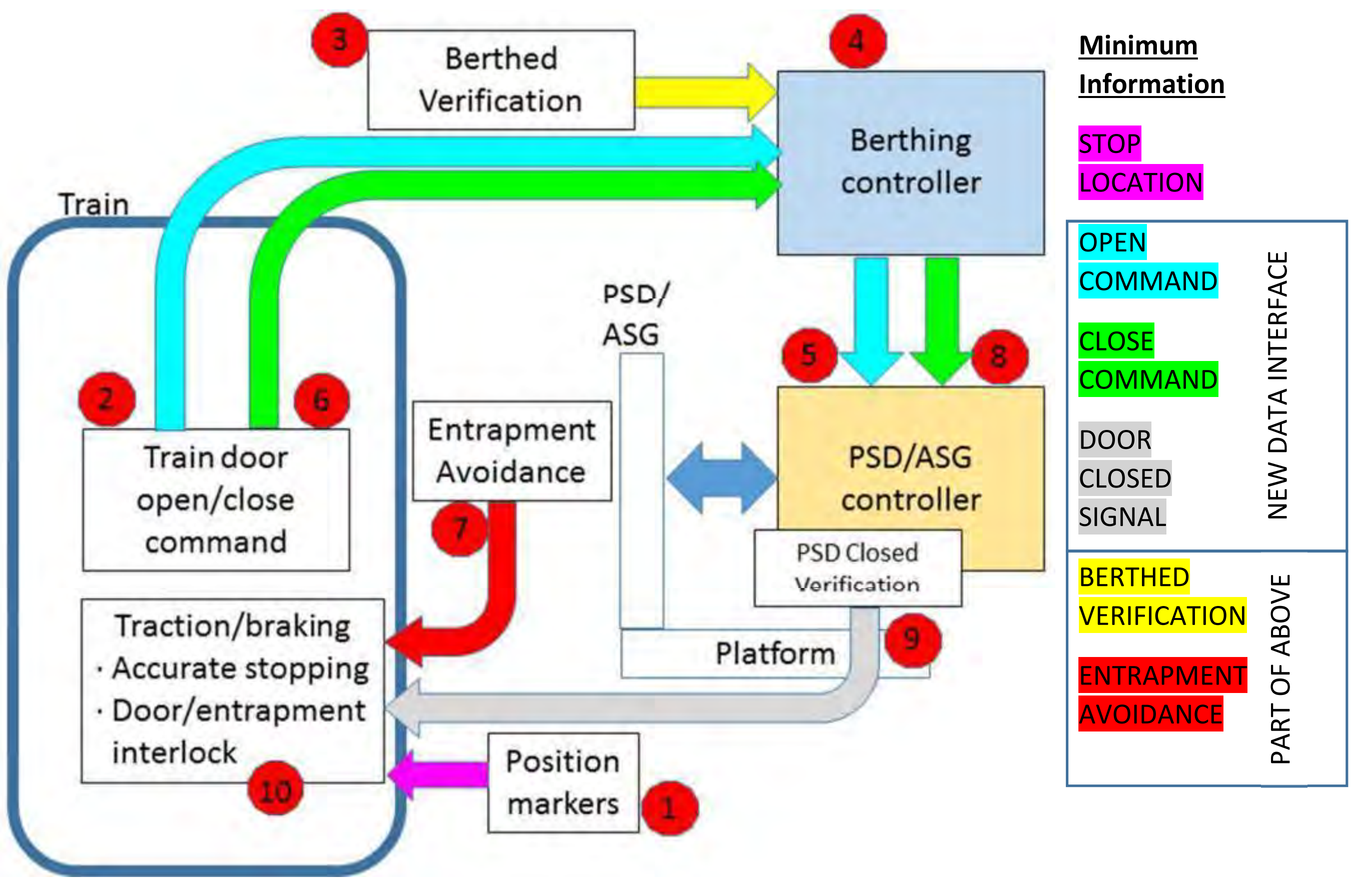
A. Accurate Stopping
   1. Reliably stop train at STOP LOCATION so that the train doors and platform doors are aligned.

B. Open Doors
   2. Transmit OPEN COMMAND from the train to the wayside.
   3. Generate BERTHED VERIFICATION if train is stopped at the correct location and is correct length.
   4. Ensure that OPEN COMMAND and BERTHED VERIFICATION are both present.
   5. Transmit OPEN COMMAND to PSD/ASG controller.

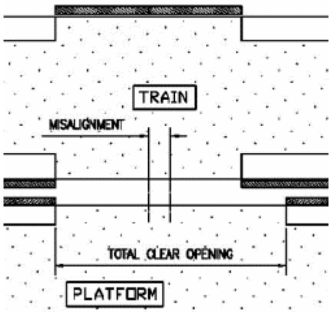
C. Dwell during passenger boarding/alighting

D. Close doors
   6. Transit CLOSE COMMAND from train to wayside.
   8. Transit CLOSE COMMAND to PSG/ASG controller.

E. Safe Movement
   7. Ensure ENTRAPMENT AVOIDANCE by mechanism, geometry, rule, or technology.
   9. Transmit DOOR CLOSED SIGNAL from wayside to train.
   10. Accelerate from station when safe to do so.



Berthing Control Comparison



Stop Location

In order for passengers to enter and exit the train safety, the train doors and platform doors must be aligned. While Paris RATP only requires a 31.5" clear opening, a design for NY should meet the ADA Accessibility Guideline of 36".

Without some form of ATO in place, NYCT will be reliant on the train operator stopping the train within the door tolerance calculated by:

$$misalignment\ tolerance = 0.5 * \ (platform\ opening) + 0.5 * (train\ opening) - 36"$$

The standard methods of improving operator stopping accuracy are (1) stop marker signs visible to the engineer and (2) training. Based on the experience of TfL and Shanghai, this is normally sufficient.

ClearSy has a 'distance totem' which calculates and displays how far the train is from the stop target. It is unclear how beneficial this totem would be in practice, or if it would conflict with signal visibility.

Berthed Verification

Opening of the platform doors is prevented unless the train is stopped within the misalignment tolerance. Opening of some or all platform doors is also prevented if the train is not the full length of the platform. Three methods of verifying the berth location are describe below.

Communication Based Train Control

Utilizing CBTC is feasible if it has accurate location information, accurate train length information, and a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to the schedule/cost impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

ClearSy's COPP system provides a dedicated loop antenna which is placed below the train at the berthing location, with paired antennas installed on the underside of all potential lead vehicles. The loops are sized so that communication is only possible if the train is stopped within tolerance.

On systems with various train lengths the system must also verify train length. This is accomplished with additional loops installed where the rear of the train may berth. Paired antennas must be installed on the underside of all potential trail vehicles.

Magnetic, Laser or Optical Scanners

Where installation of equipment onboard is undesired, berthing location can be verified via remote sensing of the train speed and location. As an example, ClearSy's Coppilot system utilizes wayside sensors to monitor the speed and location of vehicles at the platform.

Where train length may vary, additional sensors are installed where the rear end of the train may berth.

Open Command , Close Command

While not absolutely required, it is suggested that the door open and closed commands be synchronized between the train and platform. The four methods currently in use are described below.

Via Train Control

Utilizing CBTC is feasible if it is interfaced to the doors and has a data path to the wayside. A downside of this method is that it requires additional testing of both safety systems (doors and CBTC). Due to this cost/schedule impact, Paris and Jubliee lines did not connect the ATO system to the PSD/ASG system.

Dedicated Loop

The dedicated loop discussed above (see: Dedicated Loop) may also be used to transmit open and close commands from the train to the wayside.

Radio Frequency

If the CBTC system is interfaced to the platform screen door but does not have the capability of interfacing to the onboard doors, a short range radio may be used to communicate from the train to the wayside. Due to this radio only performing a single function, the dedicated loop discussed above (see: Dedicated Loop), which can also perform berthing verification, appears to always be a better option than a short range radio.

Optically

If installation of equipment onboard is undesired, opening and closing of the train doors can be monitored by ClearSy's Coppilot system optically. Due to platform doors not being commanded to move until after the train doors have been detected as moving, this method may add 1 or 2 seconds to the overall dwell time.

For agencies with operational desires to only open specific doors, additional sensors can be placed to monitor individual doors. However, ClearSy warned that this quickly increases the cost.

Door Closed Signal

All train and platform doors must be closed before the train moves. Monitoring of the train doors is already existing onboard and would remain unchanged. The platform doors are expected to be monitored via a safety circuit that connects to every door in series. If any 'door closed' switch is open, the door is open and the safety circuit will have no power.

Appendix B

Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Issued: 5/9/18

1.0 Executive Summary

The purpose of this document is to provide a general assessment of the structural feasibility of installing Platform Screen Door (PSD) systems throughout the New York City Subway system. This document is intended to address the structural requirements for all PSD systems, common platform construction types in the New York City Subway system, and necessary modifications to the existing structures to facilitate PSD installation. It will provide a broad analysis of PSD installation in the various typical platform configurations, as well as suggested modifications where the existing construction is found to be inadequate.

A visual assessment of photos of all 472 stations in the NYC subway system and a review of record drawings of representative stations along each line indicates that over 90% of stations in the system partially or fully employ one of four common platform edge types, which will be described in further detail in this report. Stations along each line utilize similar edge types, as they were built under the same contracts at the same time. This report will, therefore, describe the structural requirements of PSDs for large portions of the system and provide an order of magnitude of necessary structural modification for large-scale installation of PSDs.

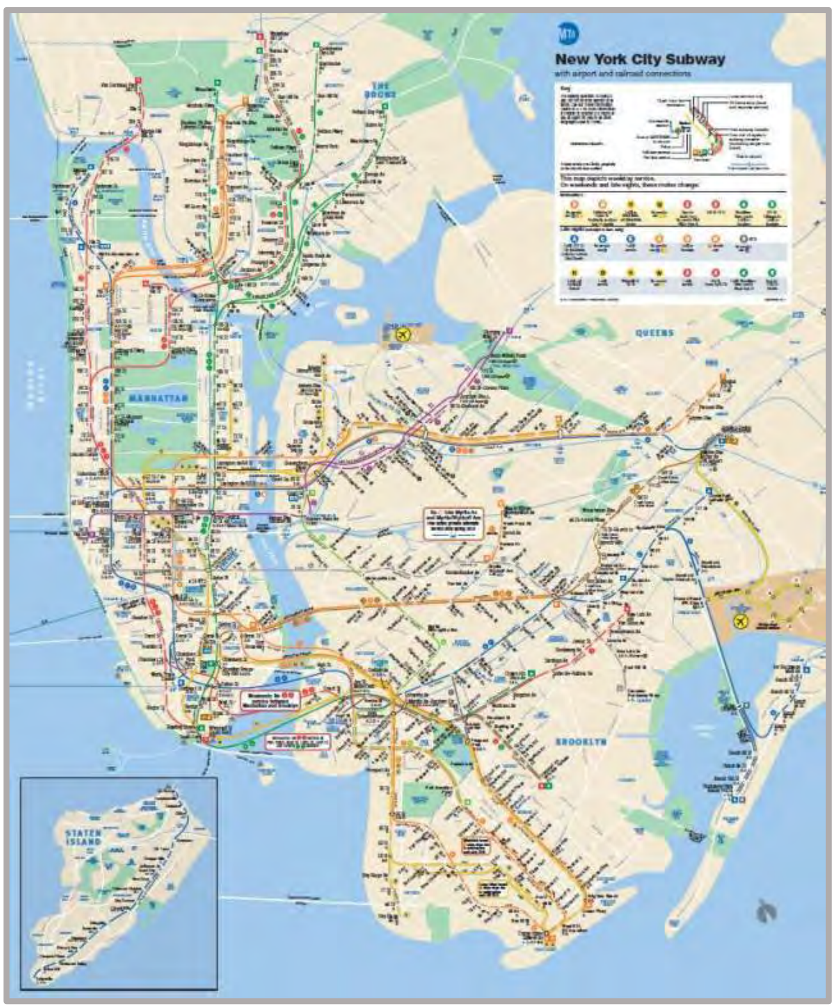


Figure 1-1 Map of the New York City Subway System

If a station is selected for PSD installation, site specific assessment will be required. Many stations will likely require structural repair of damaged or defective concrete prior to installation of a PSD system. A track alignment survey will be required and the platform edge must be reconstructed to meet NYCT-MOW Track Engineering and NYCT-CPM ADA requirements, in addition to other modifications specified herein. Additionally, there may be localized areas where platform construction in a particular station differs from the construction types described herein. This report does not consider the effects of obstructions such as columns, stairs, tapering of platform width and curved track that would not leave sufficient space for PSD installation. These must be considered on a station-by-station basis, as they vary from one station to the next and at different locations within the same station.

2.0 Project Background and Description

At the time of writing this report, STV is in the process of producing a series of feasibility studies for New York City Transit that address the installation of Platform Screen Door systems throughout the city. These studies outline the types of PSD systems in use throughout the world and the compatibility of these systems with existing NYCT rolling stock and signals technology. As these reports are being produced on a line-by-line basis, they will provide a comprehensive analysis of the challenges facing installation of PSDs at specific locations, including architectural, electrical, signals, code compliance, structural, and constructability issues.

Platform Screen Door Systems have been installed in metro systems throughout the world, with some smaller-scale installations in the United States, and are intended to prevent customers from accidentally falling, jumping, being pushed, or otherwise accessing the tracks illegally. In addition, PSDs can prevent debris and trash from accumulating on the tracks, reducing the risks of track fires. PSD systems commonly take one of two forms—a full-height barrier that extends from floor to ceiling (or fully encloses the track) or a partial-height barrier that extends some distance above the platform slab (typically at least 4'-0"). These barriers typically consist of a series of sliding glass doors, fixed glass panels and metal mullions that sit on the platform edge, with the platform doors aligning with those on the train cars.

Figure 2-1 Partial-Height Platform Screen Door System by Gilgen Door Systems

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

As a result of the feasibility studies produced by STV, it has been determined that partial-height Platform Screen Doors (also known as Automatic Platform Gates) are the most practical system for installation in the New York City Subway. The partial-height PSDs under consideration consist of a cantilevered glass and metal door system, to a height of approximately 4'-6" above the platform slab. This system provides the benefit of preventing customers from falling, jumping, or being pushed onto the track without impeding air flow within stations. Additionally, the half-height barriers allow conductors to see the train doors while they open and close, as they do currently.

In addition to the feasibility studies currently being produced, STV is in the process of producing preliminary construction documents for the design-build of half-height PSDs at the Third Avenue station on the BMT Canarsie Line ("L" Train) in Manhattan. This station will serve as the pilot program for PSD installation in the NYC Subway.

This report focuses primarily on the installation of half-height cantilevered PSDs, similar to those being proposed at Third Avenue Station. Full-height PSD systems are also discussed, although they are likely precluded in many stations due to overhead obstructions, lack of compatibility with current NYCT operating procedures, and the need for station ventilation. A full-height system would require less strength from the platform edge, but would require an assessment of the roof, canopy, or ceiling structure above. In addition, a full-height system would require an assessment of obstructions that would preclude attachment to the structure above at each station, as these conditions vary greatly, even within the same station. Full-height PSD systems are not feasible at elevated stations outside the canopy area, as they do not otherwise have a structure to support the top of the barriers.

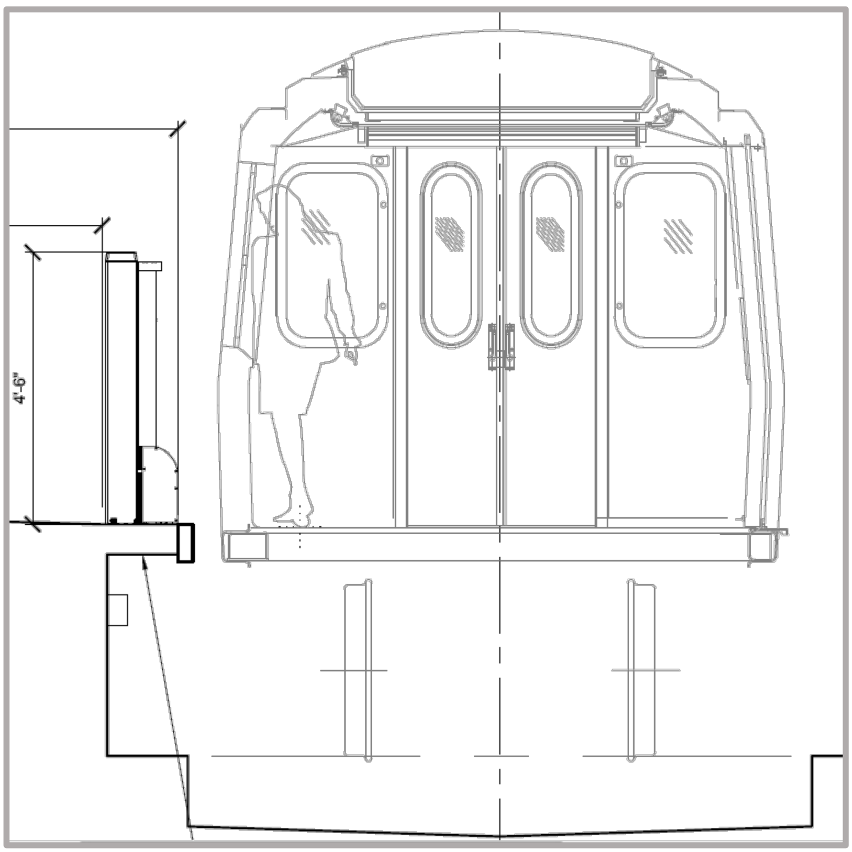


Figure 2-2 Section through Platform Screen Door System Proposed at Third Avenue Station

3.0 Structural Design Criteria

The structural design of the PSD system is governed by several loads: the "wind" load of train movement through the station, known as the piston effect, the force of a crowd being pushed against the barrier, and fatigue loading on components due to the repetitive movement of trains into and out of the station. Due to the unique nature of this project, there is no guidance on the magnitude of the design loads in current building codes or New York City Transit Design Guidelines. As a result, design loads have been determined based on manufacturers' requirements for similar installations in other metro systems around the world, such as London, Paris, and Hong Kong.

The self-weight of the PSD system will be dependent upon the actual system implemented, but for the purposes of this report, it is assumed to be about 150 lbs/ft. of barrier length. That accounts for approximately 1" thick glass, as well as intermediate mullions and mechanical equipment. This will likely be similar for both full-height and half-height barriers, as full-height barriers require more glass, but less intermediate support since they are not cantilevered. The weight of the PSD system will likely not control the design of the platform below, as it is typically wide enough such that the center of mass of the wall is located closer to the support than the edge of the cantilever. It is, nonetheless, an important consideration and the designer of record for any PSD installation project must verify the actual weight of any PSD system to be installed with its manufacturer.

The largest force applied to the PSDs is the crowd thrust force, which was considered to be 210 lbs/ft., applied 4 feet above the platform slab along the length of the doors. The only analogous load in current building codes (including the 2015 International Building Code, adopted by New York State) is that used for guard rails, defined as a concentrated load of 200 lbs or a distributed load of 50 lbs/ft. along the length of the rail. The design load far exceeds the code requirement for guard rails and is equivalent to the load used in similar metro systems in other cities.

The piston effect produces a load that is more challenging to quantify, as it is likely highly variable depending on station geometry and train velocity, with below grade stations experiencing much higher forces than above grade stations (though above grade stations will experience wind loading and piston effect simultaneously). The design load used for Third Avenue Station (and for the analyses in this report) is 36 lbs/ft.^{2} (psf), also based on the load criteria for other cities. It is worth noting that this is in excess of typical exterior wind loads used for building design in New York, roughly equivalent to a 110 mph wind. If a large-scale installation of PSD systems is undertaken, site specific analyses of piston effect pressures in stations should be performed to create more refined design criteria. Other loading, such as snow, ice, seismic loading and thermal effects shall be considered for PSDs at all above grade stations.

Due to the repetitive nature of the loads on PSDs, fatigue is also a consideration. The design criteria for this project, based on similar installations in other cities, is to design the PSD system and its components for a fatigue load of ±11 psf, with an expected frequency of 185,000 cycles/year. Steel components of the door system and anchorage to the slab can be analyzed for fatigue using procedures defined by the American Institute of Steel Construction (AISC). If post-installed anchors are utilized to connect the PSD to the slab, an independent laboratory test for fatigue should be undertaken, as fatigue and dynamic load testing data are not readily available. The effects of fatigue on the concrete platform slab are less clear, as concrete fatigue is not an issue addressed by American building codes. The American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications provides some guidance on fatigue effects in concrete, which can be adapted to ensure that the platform edge is sufficiently reinforced to support cyclical loading. This will be discussed in further detail in **Section 5.0**.

4.0 Description of Existing Platform Types

Though the New York City Subway system is extraordinarily expansive, with 472 stations, a surprisingly small number of designs were employed for platform slabs. A visual assessment of photos of all stations and an analysis of record drawings for select stations along each line to confirm visual observations indicates that over 90% of stations in the system primarily employ one of four basic platform types. Individual platforms may differ in localized areas, as they have been expanded and modified throughout the 114 year history of the subway system, but almost all platforms partially or fully utilize the systems described below.

4.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Prior to about 1935, below grade (and some open cut) stations constructed for the IRT, BMT and IND subways utilized cast-in-place concrete platform slabs with inverted steel WTs embedded in the concrete at a spacing of 20 inches on center. Rather than being a true concrete cantilever, the steel cantilevers approximately 1'-2" over the supporting wall below and a thin concrete slab spans between the two adjacent WTs. A continuous steel angle runs along the edge of the platform. The concrete slab contains little or no reinforcing. A topping slab provides additional thickness, as well as a slope toward the tracks. See **Figure 4-1** below for additional information.

This slab type is inadequate to carry the weight of the new PSD system and its design loads, whether half-height or full-height barriers are used. Due to the lack of reinforcing in the slab edge, it is recommended that slabs constructed in this manner be rebuilt and tied into the existing structure through the use of dowels and epoxy bonding agents. This will be further discussed in **Section 5.0**. Typically these platform slabs are supported by continuous concrete walls, which will experience minimal additional loading due to the PSDs.

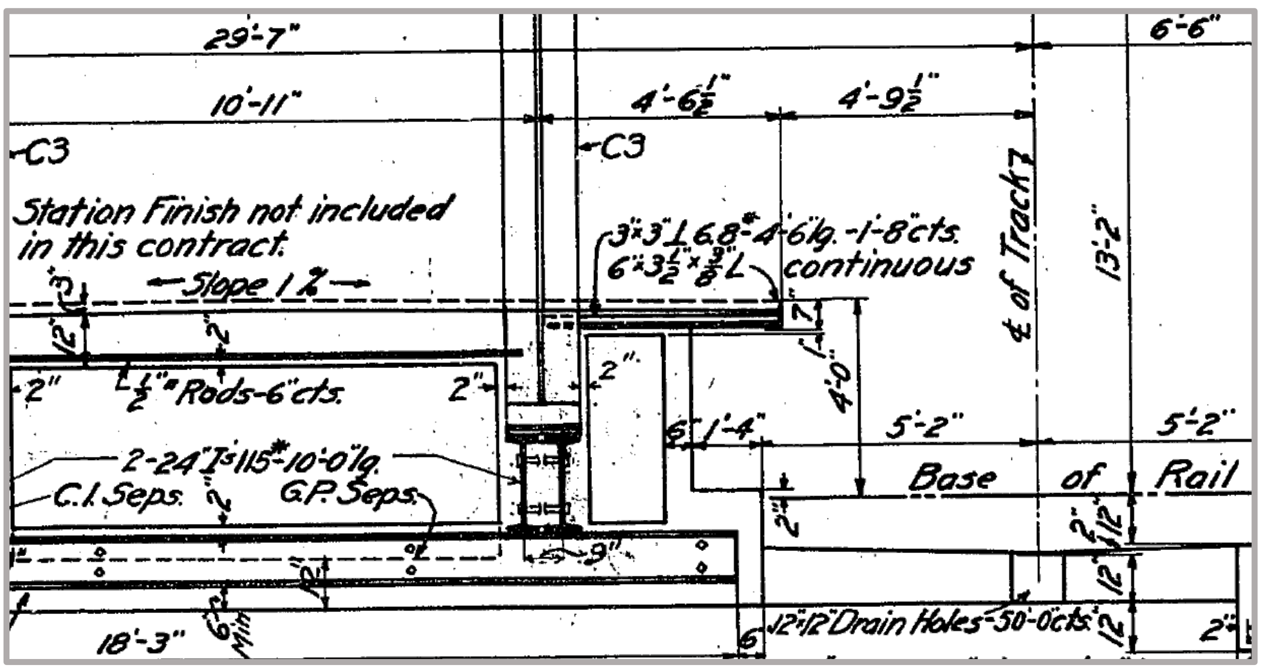


Figure 4-1 Partial Section of Platform at President Street Station (IRT Nostrand Avenue Line, Brooklyn; "2" & "5" Trains) showing Inverted WT Construction. Station was opened in 1920.

4.2 Cast-In-Place Concrete Slab with Steel Rebar

In newer below-grade stations, particularly those built after 1935, and some open-cut or at-grade stations, the platforms are approximately 6" thick cast-in-place concrete slabs with steel rebar, similar to what one might expect if the station were constructed today. The cantilever is typically about 1'-2" long, from the face of the supporting wall. In some cases, a continuous steel angle may be utilized at the edge of the slab, behind the rubbing board. If present, this angle is typically cast into the slab with steel straps. See **Figure 4-2** for one example of this type of platform construction.

The rebar in this slab, as well as the cantilever length, varies from station to station and within many stations. As a result, its ability to support the loads produced by the PSD system will vary and a site specific analysis must be performed. Some stations, particularly newer stations, will be able to support the PSDs without modifying the platform slab, but some older or deteriorated slabs may require a partial or full rebuild. These slabs are more likely able to support full-height barriers than half-height barriers, as the full-height barriers produce only a shear force at the base, whereas half-height barriers are cantilevered and produce a rotation at the edge of the cantilever. In order to prevent base rotation, full-height barriers must also have top supports connected to the roof structure of the station, which may be difficult if there are overhead utilities, signs or other obstructions. The roof structure must also be checked both locally and globally for the effects of PSD loading, which must be done on a station-by-station basis.

Slab repair and modification work will be discussed in further detail in **Section 5.0**. Additionally, the effects of loading on the support structure below shall be considered. In many cases, the platforms are supported by continuous concrete walls, which can support the PSD system and will experience minimal additional loading. In other cases, or where the walls are found to be deteriorated or deficient, the supporting structure may require reinforcement or reconstruction in order to support the PSD weight and its design loads.

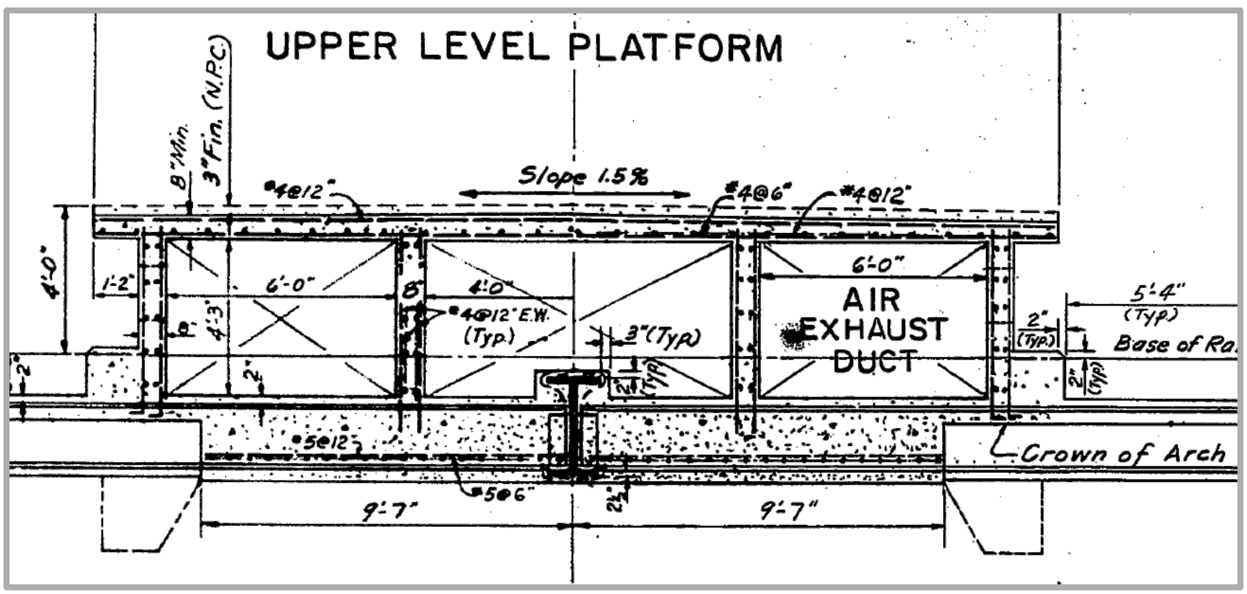


Figure 4-2 Section through Platform at Jamaica Center-Parsons/Archer Station (IND/BMT Archer Avenue Lines, Queens; "E", "J", and "Z" trains) showing Cast-in-Place Concrete Cantilever Construction. (Station was opened in 1988.

4.3 Precast Concrete Platform (Elevated Stations)

Starting around 1960, the wood platforms at elevated stations were replaced with predominantly precast concrete slabs. About 70% of elevated platform structures consist, at least partially, of precast concrete slabs. These are typically double-tee beams supported by the steel track structure below. The overall width of the beams varies, but the stems are typically 3'-0" apart. Some of the precast beams are prestressed and contain prestressing tendons in addition to mild reinforcing steel. The stems of the tees are connected to short pipes, which are welded to the steel platform girders below. Between stems, the slab is fairly thin, about 3 ½" thick, and reinforced with welded wire fabric. See **Figure 4-3** for a typical detail of a prestressed platform slab.

While the overall design of precast concrete platforms varies from line to line (typically, multiple stations were completed under one contract with the same details), the precast concrete platforms generally cannot support the design loads of a PSD system. The thin slab is not capable of withstanding the rotation created by a cantilever PSD system, as it will experience torsional forces between stems. As a result, any precast beam will require some degree of reinforcement, largely driven by the spacing of the stems. Additionally, the steel station structure and pipe supports for the precast beams must be analyzed on a site-specific basis for added weight and additional imposed loading. The reinforcing of precast concrete platforms is discussed in further detail in **Section 5.0**.

The PSD system may also present logistical challenges in a precast structure, as the base connections and necessary penetrations for conduits may interfere with existing reinforcing or prestressing steel. A cast-in-place concrete slab allows for the use of post-installed adhesive anchors at base connections or for the slab to be rebuilt with base connections cast into the slab. This is not possible with a precast concrete slab, as the use of post-installed anchors would be precluded by the thin slab. The only viable option for a base connection is the use of thru-bolts, which may be challenging, as the stems and existing reinforcement must be avoided. Installation of PSDs at elevated stations with precast concrete platforms will present substantial challenges, possibly necessitating major modifications to the existing structures.

Full-height PSD systems are likely precluded from use at nearly all elevated stations, as they do not have canopy structures running the full length of each platform to support the top of the barrier. If a full-height barrier is to be used, it would have to be cantilevered in a similar way to the half-height barriers and would produce a greater base reaction at the platform slab edge.

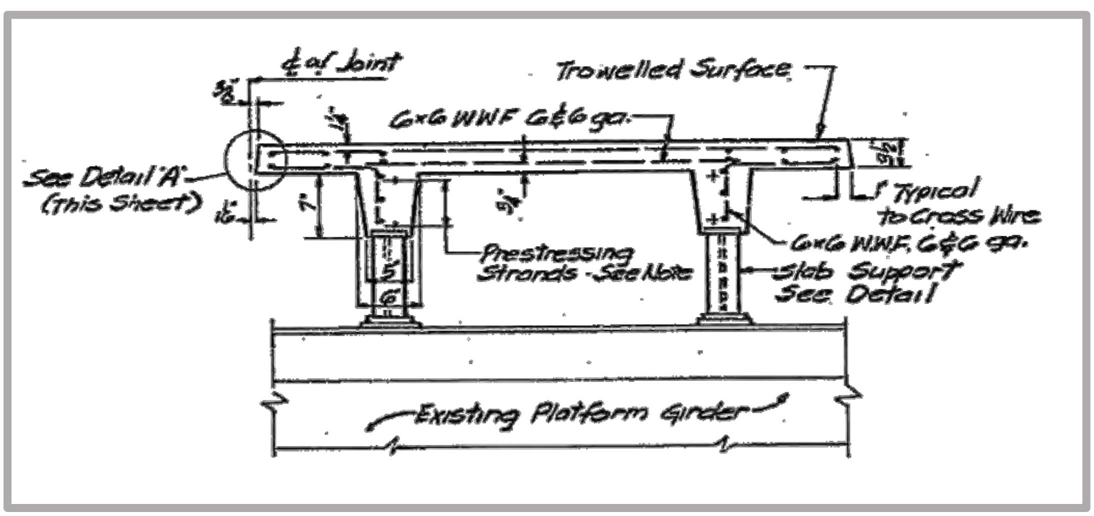


Figure 4-3 Section through Typical Prestressed Concrete Platform Slab (IRT Pelham Bay Parkway Line)

4.4 Cast-in-Place Concrete Slabs (Elevated Stations)

While the majority of elevated stations have precast concrete platforms, some stations and portions of nearly all stations have cast-in-place concrete platforms. Typically these are found in stations where the platform is located above the mezzanine, or near the head house if the station does not have a mezzanine. In nearly all cases, these cast-in-place concrete platforms are supported by steel platform girders. Like the below grade cast-in-place platform slabs, these platforms are highly variable depending on station geometry, configuration of the steel framing below, and time at which they were constructed. Some platforms are more heavily reinforced than others and the cantilever length (beyond the girders below) varies by location. See **Figure *4-4*** Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)**Figure *4-4*** for one example of a cast-in-place concrete slab at an elevated station.

At these stations, or sections of stations, the concrete slab will have to be analyzed on a site-specific basis to determine its ability to carry additional load at the platform edge. Modification or reconstruction of a portion or all of the platform may be required in order to support the PSD system at some locations, while others will require little to no modification. Elevated stations are much more variable than below-grade stations, as they were built at different times, under different contracts, and for different rail companies. As a result, there will not be a "one size fits all" approach for modifying these slabs. Some potential modification options will be discussed in further detail in **Section 5.0**. Additionally, the platform structure below will have to be analyzed for the impact of additional loading due to torsion at the base of the PSD and added weight of the system. The steel structure may require reinforcement if it is found to be insufficient to support the PSD system.

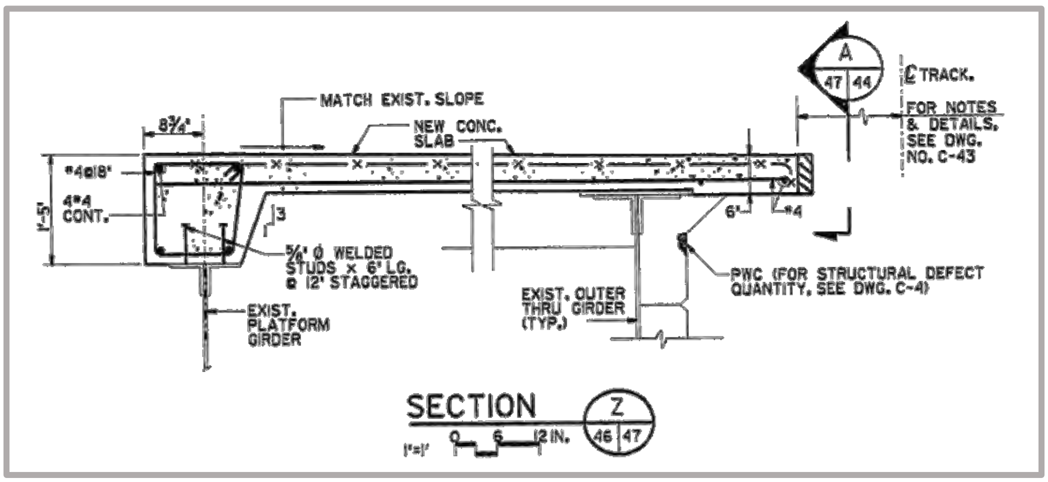


Figure 4-4 Typical Cast-in-Place Concrete Slab Detail for Rehabilitation of Stations on the BMT Broadway-Jamaica Line ("J" & "Z" Trains)

4.5 Other Known Platform Types

While the four platform types described in this section cover about 90% of stations in the system, some other platform types do exist and will have to be dealt with on a case-by-case basis if PSDs are installed at those locations. Some elevated stations utilize precast concrete planks other than double-tees, which can be evaluated at each site independently. If they are found to be insufficient, the platform would likely have to rebuilt to support the PSD system. Additionally, one elevated platform (Court Square on the IRT Flushing Line) utilizes fiberglass (GFRP) platforms. This platform could not be reinforced traditionally and would have to be rebuilt if the GFRP is unable to support the PSD design loads.

APPENDIX B - Report on Structural Feasibility of Platform Screen Doors for System-Wide Installation

Some stations, particularly in Brooklyn and Queens, employ open-cut construction, which is similar to, yet distinct from below-grade stations. These stations typically utilize cast-in-place concrete platform slabs, but they are not supported by a continuous concrete wall like nearly all of the below-grade stations. Additionally, some sections of these stations have little or no cantilever toward the tracks. The concrete at many of these stations is significantly deteriorated (likely due to exposure to rain, snow, and de-icing salt over the last 100 years or more) and extensive reconstruction of the platforms would likely be necessary in order to install PSDs at these locations. Where the concrete is observed to be in good condition, site-specific assessments are needed to determine the adequacy of the existing structure to support the PSDs.

One distinct section of track is the IND Rockaway Line in Queens. This section of track was originally operated by Long Island Railroad and is unlike any other portion of the NYC Subway system. The tracks are elevated on a steel viaduct encased in concrete, giving the appearance of a reinforced concrete viaduct. The platform slabs are cast-in-place concrete and have longer cantilevers than elsewhere in the system (up to 2’-9”), but were rebuilt in 2014 and can support the loads due to a PSD system without major reconstruction. Some modification would be required to accommodate electrical systems and conduits for the PSD system. A more detailed analysis is required to determine if the supporting structure can support the added loads from the PSD system, considering the effects of added weight, seismic loads, and wind loads, as well as any locally critical areas or areas in need of repair. This type of construction affects (8) stations. A typical detail for platform construction along the IND Rockaway Line is shown in **Figure 4-5**.

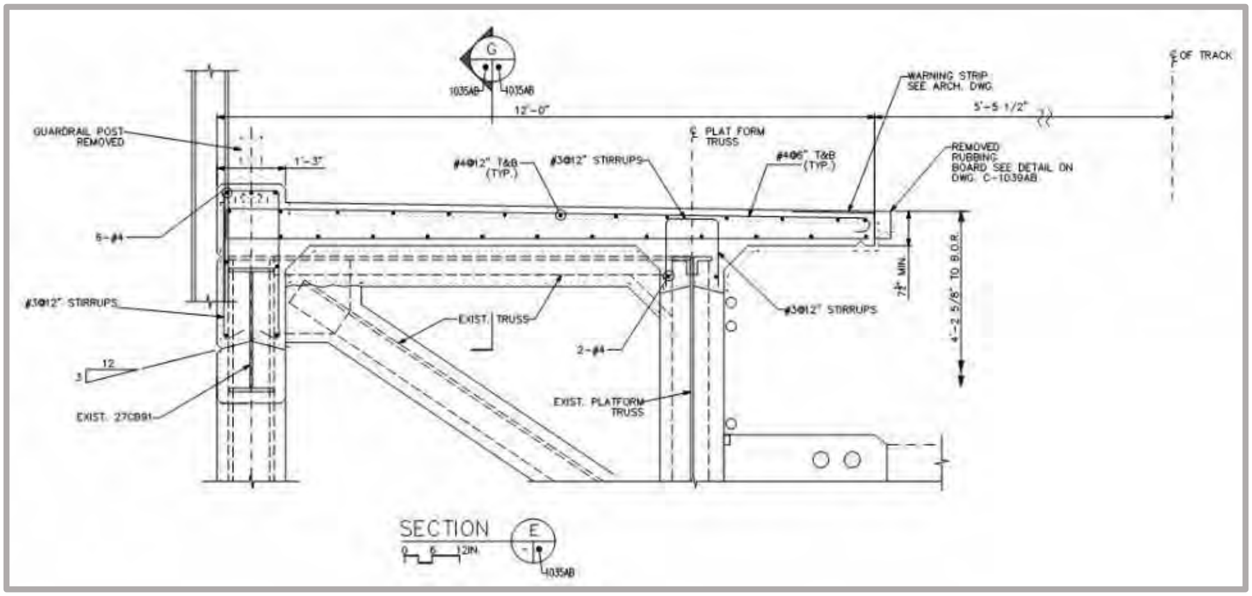


Figure 4-5 Section through Typical Platform Construction along the IND Rockaway Line in Queens

5.0 Required Platform Slab Modifications

5.1 Cast-In-Place Concrete Slab with Embedded Steel WTs

Cast-in-place platform slabs supported by steel WTs are insufficient to support the PSD system, as the structural slab is very thin and contains little or no reinforcement. As a result, it is recommended that the steel WTs be removed and the slab be rebuilt to a thicker dimension with sufficient rebar to support the PSDs. The existing condition consists of an approximately 3" thick structural slab with an approximately 3" thick topping slab. If the topping slab is fully removed, a 6" thick structural slab can be constructed. This provides sufficient reinforcement to support the PSD system and allows for cast-in base connections or conduits as needed. The exact reinforcement will be dependent upon the cantilever length, but a 6" thick slab will be sufficient for a cantilever length of up to approximately 3'-0", greater than what is typically found in below-grade stations. Removal of the existing concrete slab over a duct bank (a condition which exists in many below-grade stations), carries a risk of damaging the ducts. As a result, non-destructive testing should be utilized to identify the depth to the ducts prior to demolition. It may be necessary to rebuild the top layer of the duct bank in order to accommodate the new slab, which requires temporarily relocating these cables.

A new topping slab can be provided in addition to the 6" structural slab, which will provide additional surface for durability, allow for equipment to be flush with the concrete surface, and raise the platform to ADA height. This work may be performed in conjunction with an adjustment in vertical track alignment in order to achieve the desired platform height. This is similar to the proposed construction at the Third Avenue station on the BMT Canarsie Line, shown in **Figure 5-1** and **Figure 5-2**. If a topping slab does not currently exist, other options, such as lowering the bottom of the slab, may be explored to achieve the required 6" minimum thickness. Where it is not possible to lower the bottom of the slab due to the presence of a duct bank, it may also be possible to raise the track alignment to achieve the desired platform slab thickness and height.

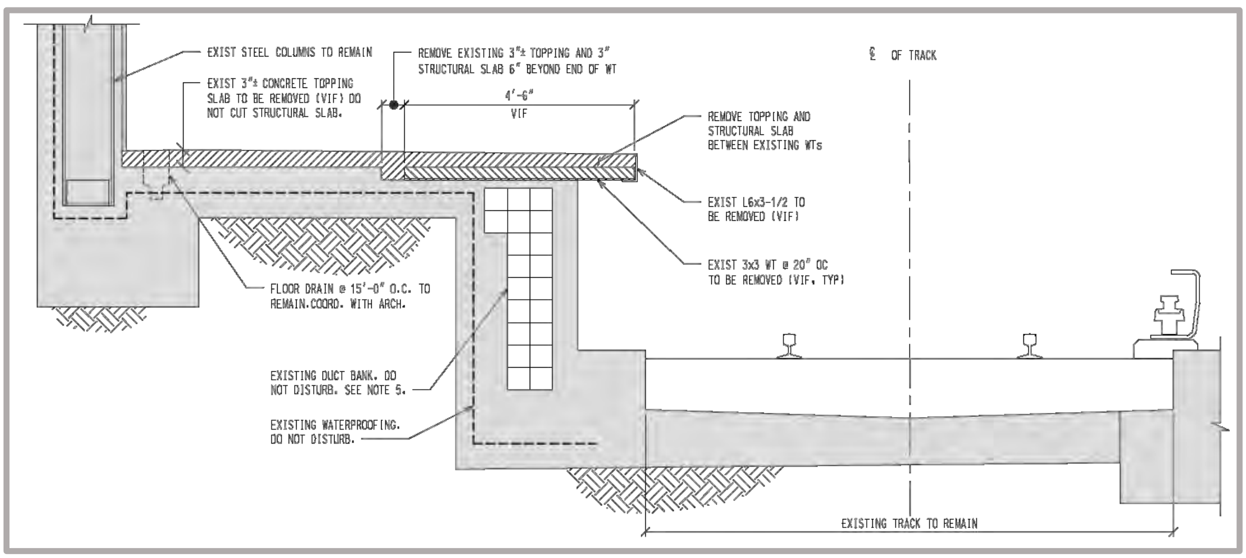


Figure 5-1 Proposed Demolition of Concrete Slab with Steel WTs at Third Avenue Station

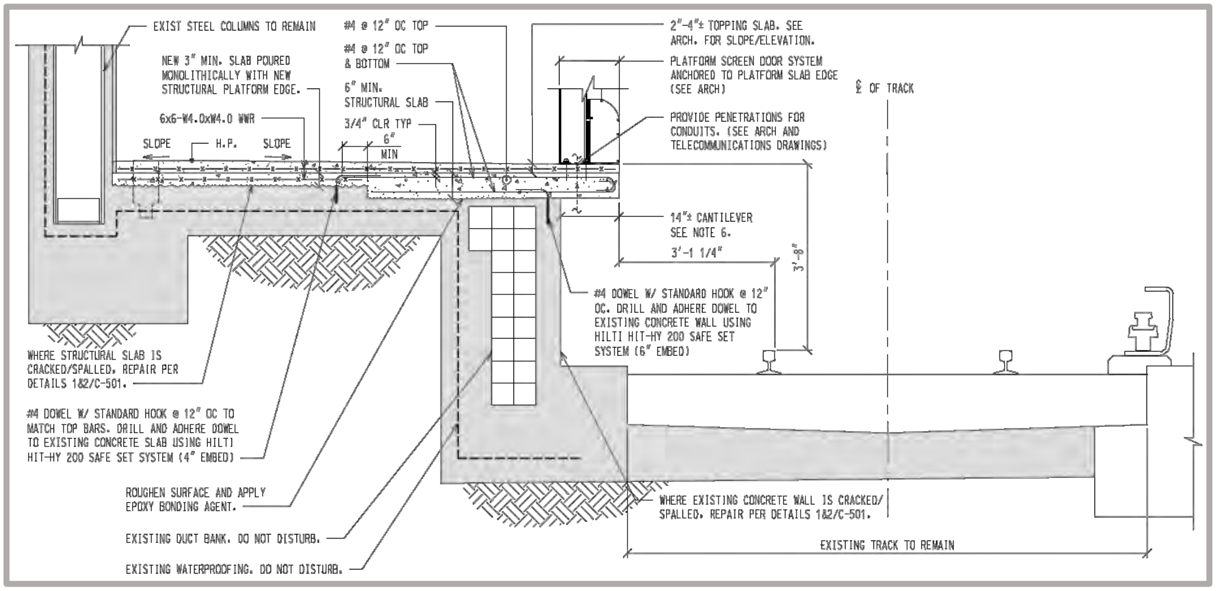


Figure 5-2 Proposed Reconstruction of Cast-in-Place Concrete Platform with PSDs at Third Avenue Station

5.2 Cast-In-Place Concrete Slab with Steel Rebar

Reinforced cast-in-place concrete platform slabs may have sufficient capacity to support a PSD system and a site-specific analysis of the slab is necessary to make this determination. If sufficient capacity exists, the PSD system can be anchored to the concrete slab using post-installed anchors. The PSD system may require core-drilled holes for conduits and cables to pass through the slab, which must be coordinated with any existing reinforcement. In addition, any deteriorated concrete must be repaired prior to installation of a PSD system.

If the platform slab is found to be insufficient to support the PSD system, the slab can be reconstructed in a manner similar to the cast-in-place slab with steel WTs. The cantilever and a portion of the backspan can be removed while preserving concrete and rebar in the remaining portion. New rebar can be doweled into the remaining portion of the slab and a new cantilever can be poured with any necessary base anchors or conduits cast in. Alternatively, or if the slab is severely deteriorated or damaged, the entire platform slab can be rebuilt with sufficient capacity to support the PSD system. A topping slab can be provided for added durability and to allow for flush-mounted equipment in the concrete.

5.3 Precast Concrete Platform (Elevated Stations)

The precast double-tee beams used at most elevated stations have very thin slabs (approximately 3 ½" thick) and are unable to support the added load due to a PSD system. Reinforcing these platforms is somewhat more complex than at below grade stations, as the precast concrete cannot be cut and partially reconstructed. In order to reinforce these members, new concrete must be added between the stems of the double-tee to stiffen the slab. A layer of reinforced concrete approximately 4" thick would be required to reinforce the slab, with dowels drilled into the stems of the double-tee.

Construction of this reinforcement would be challenging, as it is between the steel platform and the underside of the platform. In some stations, this may be possible through the use of stay-in-place formwork, but in other locations there may not be enough space to construct the reinforcement. Additionally, the use of stay-in-place forms is not desirable visually, as they will ultimately rust, giving the appearance of structural damage in publically visible areas. In order for any new reinforcement to be added, dowels must be provided at the stems of the precast tees, which carries a considerable risk of damaging the tendons. Non-destructive testing measures and probes must be utilized to lower this risk, which complicates the work and increases cost. The proposed reinforcing is shown in **Figure 5-3**.

The stations would require additional modifications for the installations of cables and conduits below the slab edge, as the platform does not cantilever in a similar way to the underground stations' cast-in-place platforms. Running cables and conduits parallel to the track would be complex, as they cannot simply pass through the stems of the double-tee beams. Penetrations through the stems and their reinforcement would significantly reduce the capacity of the double-tees and is not acceptable. Conduits would have to run below the precast-concrete, which may not be compatible with the PSD system. In addition, there may be obstructions in the steel framing below. Additional slab penetrations are necessary to bring electrical and signals wiring to the doors themselves, but these must occur between stems and the stems may be located directly below the doors. In short, modifying the precast concrete platforms to support the PSD system and its associated equipment is structurally possible, but may not be constructible given the complexity of these stations. If that is the case, the only option would be total reconstruction of the platform using either cast-in-place concrete or precast concrete specifically designed for PSD systems.

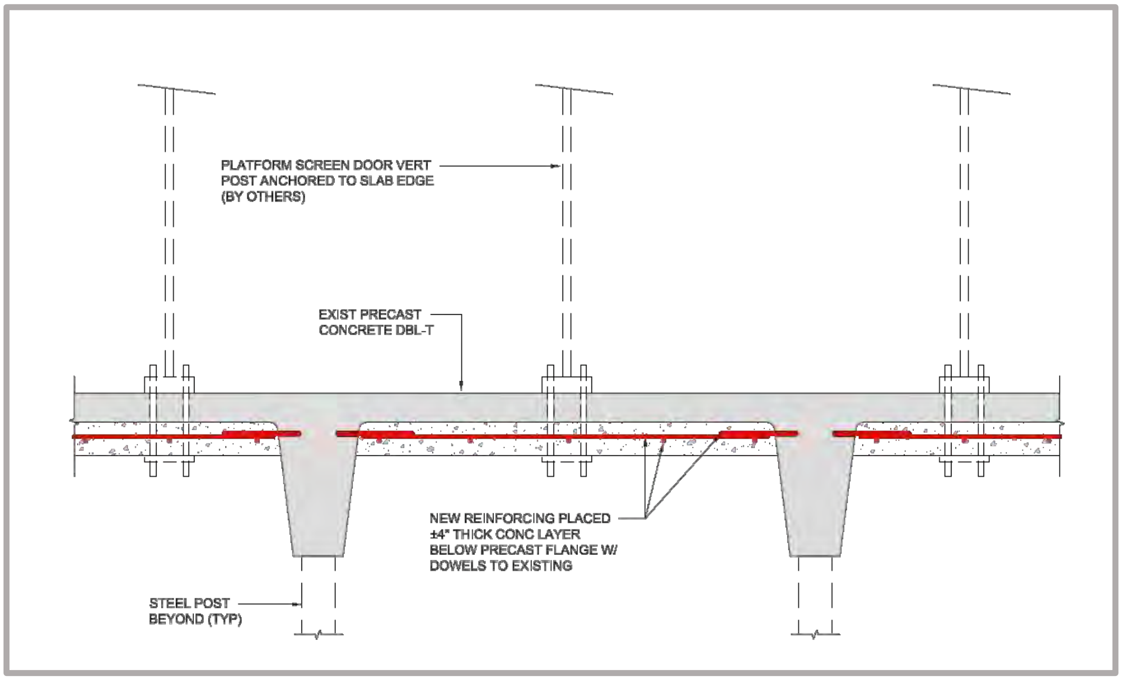


Figure 5-3 Section through Precast Double-Tee Platform Slab showing Possible Reinforcing (View from Track)

As nearly all elevated stations are supported by steel framing, the strength of the steel should be verified on a station-by-station basis to determine that it can support additional superimposed loads due to the PSD system.

Where cast-in-place concrete slabs exist above mezzanines, special consideration must be given to any waterproofing present. If the slab is partially rebuilt or if openings are drilled or cut for conduits and anchor bolts, any waterproofing membrane between the platform and mezzanine must be maintained.

5.4 Cast-in-Place Concrete Slabs (Elevated Stations)

As with below-grade stations, elevated stations with cast-in-place concrete slabs may have sufficient capacity to support the PSD system, depending on slab thickness and reinforcement, and must be analyzed on a site-by-site basis. Newer stations (or recently rehabilitated stations) are more likely to be able to support the design loads and are least likely to be deteriorated or require repair. Modifying cast-in-place platforms is less complicated than modifying precast platforms, as a portion of the slab can be removed and replaced with more heavily reinforced concrete, similar to what is proposed for below grade stations. This allows for better coordination with any potential penetrations through the slab, as well as anchor bolts for the PSDs.

If the slab is found to be severely damaged or deteriorated, the entire platform may be reconstructed. In addition, a topping slab can be provided, similar to below-grade stations, though the added weight of a topping slab may not be acceptable at elevated stations. The steel framing of elevated stations should also be verified to determine if it is capable of supporting the added weight and applied loads due to the PSD system and added concrete. Reinforcing (involving plates field-bolted to the framing) may be necessary in some locations. Deteriorated or damaged platform framing should be replaced or repaired.

5.5 Other Known Platform Types

While approximately 90% of platforms in the system can be considered one of the four types previously described, some outliers do exist. Precast concrete planks are utilized in some stations, where they span between steel girders. If these planks are found to be insufficient to support PSD installation, it is possible to reinforce them in a similar fashion to the double-tees. It may also be possible to reinforce the concrete with FRP if the bottom face requires additional tensile capacity. Precast planks present a similar challenge to the double-tees, as they require penetrations to be core-drilled while avoiding existing reinforcing or pre-stressing tendons.

Stations along the Rockaway Line and open-cut stations utilize cast-in-place concrete slabs and can be modified using the techniques described in Sections 5.2 and 5.4. Partial or full removal and replacement of the platform would provide a suitable structure to support the PSDs and its associated equipment. This also allows for necessary embedded equipment or penetrations. Many open-cut stations are deteriorated due to exposure to the elements and would likely require repair of concrete supporting the platform.

6.0 Other Structural Considerations

6.1 Global Stability Concerns

While this report has generally focused on localized loading due to the installation of PSD systems, the global stability of each station structure must also be taken into consideration for elevated stations. As nearly all elevated station structures are partially or fully open structures, the PSDs are subject to substantial wind loads. As a result, the overall projected wind area of each station may increase. This is a global analysis that must be done on a station-by-station basis in order to determine that the beams supporting the platforms, as well as the columns and frames below the station, are adequate to resist the larger wind loading. If they are found to be insufficient, reinforcement may be necessary through the use of field-bolted plates.

Similarly, the installation of PSD systems will add to the seismic weight of the elevated stations, increasing the seismic loads experienced by each station. While this must be taken into consideration on a case-by-case basis, it is not likely that the effective seismic weight of the structure will increase by greater than 10% due to the additional PSD self-weight. If it is in fact less than 10%, a full seismic analysis is not required by the 2015 International Existing Building Code (as adopted by the State of New York), as lateral loads have not substantially increased due to the alteration.

6.2 Deflection and Serviceability

Deflection limits for the PSD system must take into consideration any limitations of the PSD system itself (either material or mechanical system tolerances) as well as criteria set by the IBC, whichever is more stringent. The IBC sets a deflection limit for exterior and interior partitions with flexible finishes to L/120, which should not be exceeded. It will ultimately be the responsibility of the PSD manufacturer to design the system such that it can withstand the design loads without exceeding reasonable deflection limits, taking into consideration any local track curvature and train car sway as potential collision obstacles.

Whether located in elevated or below-grade stations, the PSD system will be susceptible to vibrations due to wind load, train movements, mechanical systems associated with the PSD, and their combined effects. The PSD system and its components must be designed to withstand and accommodate these effects without affecting system performance.

6.3 Expansion Joints

PSD systems must be able to accommodate longitudinal movement due to thermal expansion and contraction. Joints between mullions and walls/doors shall be designed to move such that there are not rigid points at the mullions which could result in cracking due to expansion and contraction. Additionally, elevated station structures have existing building expansion joints along their length. The expansion joints within the PSD system must be designed to accommodate multi-directional movement at these locations. It will be the responsibility of the designer of record to coordinate the location and behavior of expansion joints at each station with the PSD system manufacturer.

6.4 Equipment Rooms

In order to support the installation of PSD systems, communications equipment rooms and storage space for PSD system parts must be provided at each station. The exact location of these rooms must be coordinated with all trades, particularly communications in order to ensure proper functionality of the PSD system. They may be located at the platform, at the mezzanine, or in other back-of-house spaces, but the capacity of the floor slab and substructure must be verified to ensure that it can support the additional load. This is likely not a problem at below-grade stations, where platforms and mezzanines have been designed for a live load of 150 psf, but elevated structures are designed only for a live load of 100 psf and will require reinforcement or modification. In addition, high-load zones of racks, batteries, material stacking, etc., must be reviewed for other specific structural effects.

6.5 Existing Utilities

Below grade stations typically have duct banks, cables, conduits, and other utilities located below the platform edge. Installation of the PSD system, modifications to the platform slab, and penetrations for PSD conduits will require altering or rerouting of these utilities. In some cases, this may require partial removal and relocation of the utilities and duct banks to accommodate the new PSD system and its associated conduits. If a full-height PSD system is provided, similar consideration must be given to lighting and overhead utilities. Additionally, in some stations, signal heads may be mounted near platform edges, which will require relocation to accommodate the PSD system and its associated utilities.

6.6 Constructability

Construction phasing and sequencing should consider temporary conditions that may result in a weakened structural element. As an example, at below grade stations, it is not uncommon for the groundwater table to be higher than the platform. If the slab is being partially demolished and reinforced, the temporary condition between demolition and the new slab being poured will be vulnerable to hydrostatic uplift pressure. Care should be taken to avoid removing the entire slab at once, as this could allow cracking and infiltration of groundwater. This, and other constructability issues, should be addressed on a case-by-case basis, as there may be multiple options to mitigate this effect.

6.7 Final Design

While this report attempts to provide a broad overview and summary of the structural implications of installing a PSD system at various station types throughout the NYC Subway System, the final design of the system must still be assessed on a case-by-case basis at each of the 472 unique stations. The designer of record for each station ultimately must verify design loading and determine the necessary modifications for that particular station. Design loads considered in this report are based on similar applications in other cities and should be independently verified prior to final design.

7.0 Summary of Recommendations

Due to the age and complexity of the stations in the New York City Subway system, nearly all platforms will require some form of structural modification or reinforcement to support the installation of a Platform Screen Door system and its associated equipment. Most platforms lack the strength to support PSDs at the edge of a cantilevered slab edge and many are deteriorated due to age and require some form of repair. As a result, more than half of below-grade stations (at a minimum) and nearly all above-ground stations require substantial reinforcement or modification of the platform slabs to support PSD installation.

Cast-in-place concrete platforms, both above and below-grade, can be partially reconstructed to provide the additional strength needed at the slab edge, as well as any necessary penetrations for wires and conduits. While this work is extensive, it will be significantly less disruptive than reconstructing the entire platform.

Modification of precast concrete platforms, common in elevated portions of the system, will be significantly more challenging than modifying cast-in-place concrete. Precast concrete cannot easily be cut to allow weak portions to be rebuilt and would require complex reinforcement and field-drilled holes for anchors and conduits. This work may be substantially disruptive to the existing structure that it may require full reconstruction of the platforms and replacement with either cast-in-place concrete or precast concrete specifically designed for PSD systems. If a large-scale installation of PSDs is planned for the New York City Subway system, perhaps the most practical solution for elevated stations is a replacement of nearly all platforms, as was undertaken in the 1960s to install the precast concrete.

In summary, Platform Screen Door systems provide unique structural demands that were not anticipated in the original design of the New York City subway system. Consequently, it is more likely to encounter platforms that cannot support these systems than those that do. Modifying these platforms to support such a system is possible, but would necessitate a large-scale overhaul of each platform, similar to what is proposed for the Third Avenue station.

End of Report

Appendix C

Emergency Egress Width Analysis

Emergency Egress Width Analysis

As part of the System-wide PSD Feasibility Study, the purpose of this memorandum is to establish a minimum platform width required for side and center platforms to be considered feasible for the design and installation of PSDs. It is not based on an actual designed installation of PSDs at a particular station but is intended to establish reasonable minimum widths to use as criteria for the study.

Assumptions:

1. NFPA130 timed egress analysis will be the final determinate regarding code compliance if and when a design is developed for the installation of PSDs at a particular station. This document is not a substitute for such analysis and it may be that particular configurations for a given station may prove that even these minimums are not enough to achieve code compliance for egress.

2. This document assumes that the minimum width of egress along the platform is determined by the size of the emergency egress doors (EEDs) exiting from the train onto the platform. In order to comply with the door leaf encroachment requirements of NYS BC 2015 (Section 1005.7.1) and NFPA130 referencing NFPA 101 2018 (Section 7.2.1.4.3.1) the width of the egress path must be at least twice the width of the largest EED.

3. In order balance the egress width from the train with the constraints of existing narrow platforms we have chosen double egress doors with two 22 inch leaves as the optimal width for each EED. This provides a reasonable egress door width from the train when improperly berthed while also providing a good fit between the motorized sliding doors (MSDs).

The worst case scenario governing the platform width is the circumstance of two simultaneous events: The improper berthing of a train and a fire or other emergency requiring evacuation of the station. In the event the train berths improperly the concept of operations should dictate that the train continue to the next station where it can berth properly to allow egress onto the platform. If for some reason, that cannot occur, egress from the improperly berthed train would through the 40 inch wide EEDs.

NFPA 101 2018, Section 7.2.1.4.3.1 and NYS BC 2015, Section 1005.7.1 door leaf encroachment is limited to 50% of the width of the egress path. Thus the door leaf width, 22 inches (assumption #3 above), becomes the determining factor in the minimum platform width. See figure 1 for side platforms and figure 2 for center platforms.

In the case of the side platform the width is measured from the face of the wall or any obstruction that occurs regularly at 15 feet on center or less to account for rows of columns that restrict widths in many stations. Benches and/or trash receptacles are episodic elements that are not considered an issue when they are sufficiently narrow and nested between columns. In the case of a continuous wall, benches and trash receptacles cannot reduce these minimums; they shall be located at platform ends, outside the path of travel, or located strategically after installation of the platform screen with EE door locations known. In the case of a row or rows of columns occurring within these minimum dimensions the total width of these columns shall be added to the minimums shown in figure 1 and figure 2.

We have examined open side and center platforms. If the side platform diagram (figure 1) were applied to all obstructions within 5’ – 11” of the platform edge (including stairs other large obstructions) there will be a large number of stations that would not comply. Since an actual design of PSDs is beyond the scope of this study we cannot know if the distribution of stairs off the platform, or other adjustments can successfully address these egress issues. Therefore we recommend not applying these minimums to these situations at this time. For the purposes of this System Wide Survey we will only use these minimums in relation to the overall surveyed platform widths.

Emergency Egress Width Analysis

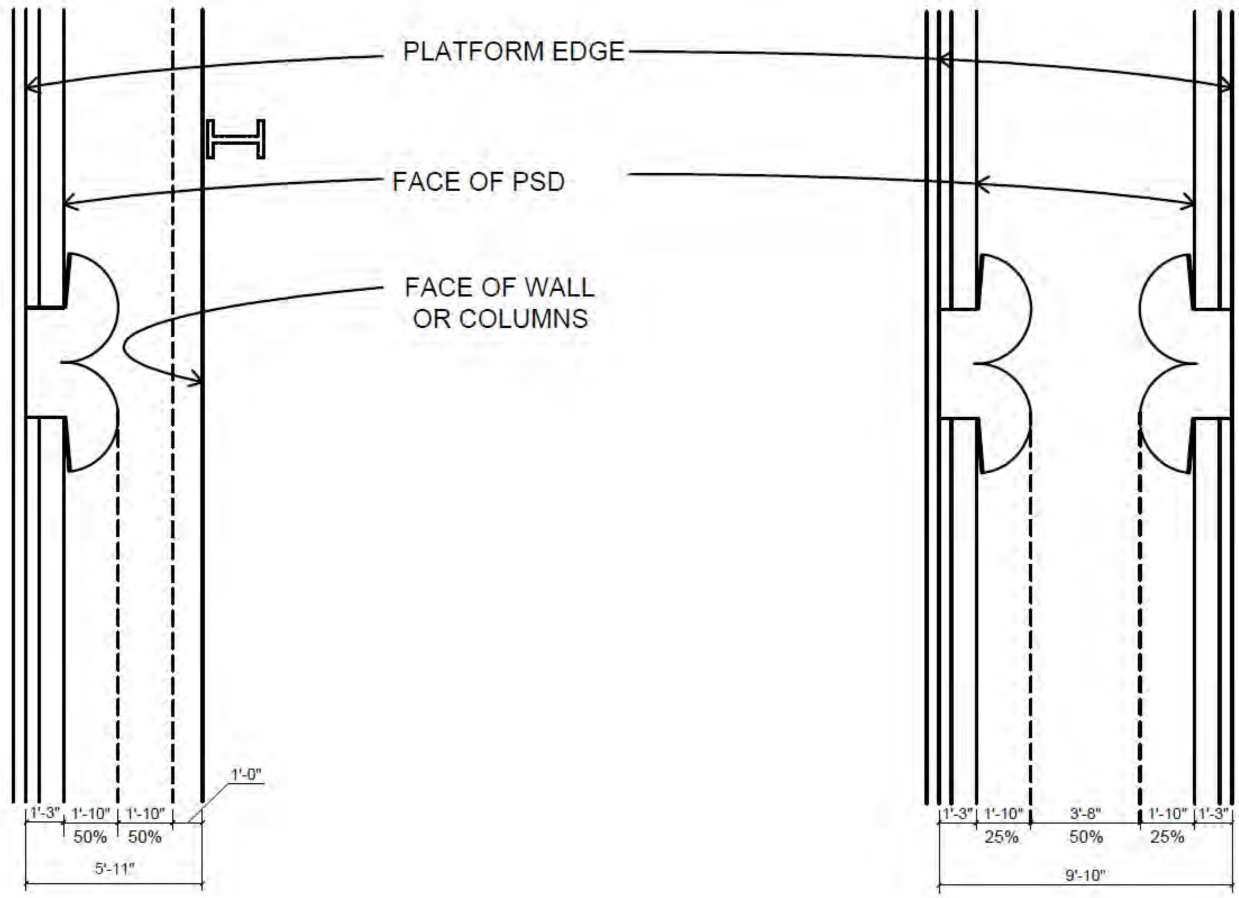


FIGURE 1: SIDE PLATFORM

FIGURE 2: CENTER PLATFORM

Appendix D

Maintenance Cost Estimate

Issued: 4/12/18

MAINTENANCE, INSPECTION & REPAIR CONTRACT
PLATFORM SCREEN DOOR PILOT PROJECT
3RD AVENUE STATION ON THE CANARSIE LINE

April 12, 2018

CONFIDENTIAL

PRICING SCHEDULE WITH OPTION FOR EXTENDED TERM OF MAINTENANCE / SOFTWARE SUPPORT

ITEM NO.	DESCRIPTION	ESTIMATE QUANTITY	RATE	EXTENDED AMOUNT	SUB-TOT 01 OPTION 3.2	SUB-TOT 01 OPTION 3.1
1	First 90 days - 24-7 full time presence on site (including daily cleaning of glass)	90	$ 4,800 per Day	$ 432,000		
	Materials and labor for preventative maintenance and remedial repair performed as needed, 24/7, for the platform screen door system and ancillary equipment. Price for year 1 is intended for preventive maintenance since remedial maintenance and repairs will be covered by the warranty period. Should warranty period be longer for the System or some of its components, price should not include items covered by warranty.	9	$ 63,500 per month [Year 01]	$ 571,500		
		12	$ 83,590 per month [Year 02]	$ 1,003,080		
		12	$ 65,683 per month [Year 03]	$ 788,196	$ 2,794,776	$ 2,794,776
2	Training for 100 workers - 20 / session; 16 HRS per session	5	$ 13,000 per session	$ 65,000	$ 65,000	$ 65,000
3.1	Optional Maintenance for years 4 & 5 (OPTION 1)	Year 4-5				
	Materials and labor for preventative maintenance and	12	$ 68,310 per month [Year 04]	$ 819,724		$ 819,724
	remedial repair performed as needed, 24/7, for the	12	$ 71,043 per month [Year 05]	$ 852,513		$ 852,513
	platform screen door system and ancillary equipment.					
3.2	Optional Maintenance for years 4 & 5 (OPTION 2)	Year 4-5				
	Repair and Replacement of Defective Hardware	24	$ 6,350 per month	$ 76,200		
	Technical Assistance [4 Hrs per Month]	24	$ 880 per month	$ 10,560		
	As Needed On-Site Support [1 Day per Month]	192	$ 220 per Hour	$ 2,640		
	Software / Firmware Support	2	$ 3,500 per Year	$ 42,000	$ 131,400	$ -
4	Optional Maintenance for years 6-10	Year 6-10				
	Repair and Replacement of Defective Hardware	60	$ 9,525 per month	$ 571,500		
	Technical Assistance [4 Hrs per Month]	60	$ 920 per month	$ 55,200		
	As Needed On-Site Support [1 Day per Month]	480	$ 230 per Hour	$ 110,400		
	Software / Firmware Support	5	$ 3,750 per Year	$ 18,750	$ 755,850	$ 755,850
5	Optional Maintenance for years 11-15	Year 11-15				
	Repair and Replacement of Defective Hardware	60	$ 12,700 per month	$ 762,000		
	Technical Assistance [5 Hrs per Month]	60	$ 1,200 per month	$ 72,000		
	As Needed On-Site Support [1.5 Days per Month]	720	$ 240 per Hour	$ 172,800		
	Software / Firmware Support	5	$ 4,000 per Year	$ 20,000	$ 1,026,800	$ 1,026,800
6	Optional Maintenance for years 16-20	Year 16-20				
	Repair and Replacement of Defective Hardware	60	$ 15,875 per month	$ 952,500		
	Technical Assistance [6 Hrs per Month]	60	$ 1,500 per month	$ 90,000		
	As Needed On-Site Support [2 Days per Month]	960	$ 250 per Hour	$ 240,000		
	Software / Firmware Support	5	$ 4,500 per Year	$ 22,500	$ 1,305,000	$ 1,305,000
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 2) [DEFAULT OPTION AS PER RFP DOCUMENTATION]		TOTAL:	$ 6,078,826	$ 6,078,826	$ 7,619,663
	TOTAL OPTIONAL MAINTENANCE YEARS 1 THRU 20 (ITEM 3 OPTION 1)		TOTAL:	$ 7,619,663		

ITEM NO.	DESCRIPTION		RATE	
7	Labor Bill Rate (per hour)	Year 1	$ 238 per hour *	
	Task Orders (Rate in Effect 24/7/365)	Year 2	$ 248 per hour *	
		Year 3	$ 257 per hour *	
	Optional :	Year 4	$ 268 per hour *	
	Optional :	Year 5	$ 278 per hour *	

Note: Labor rate is deemed to include all relevant tax and insurance, medical, pension, vacation fund, etc., travel time to and from project site and night/shift/weekend/holiday work i.e. 24/7 Rate

* Labor rates include Contractor's Overhead & Profit and Insurance (Refer Annual Maintenance Cost Breakdown) and are escalated at 4% per annum

Appendix E

Rough Order of Magnitude Costs

VJ ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

COST ESTIMATE

ESTIMATE TYPE:	ORDER OF MAGNITUDE COSTS
CLIENT:	STV INC.
CONTRACT NO.:	C-32516
OWNER:	MTA/NYCT
PROJECT DESCRIPTION:	Tier 2-3 Report on Feasibility of Platform Edge Barriers for Franklin Avenue Shuttle
ESTIMATE DATE:	July 25, 2019

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VJ ASSOCIATES
ORDER OF MAGNITUDE COSTS

ASSOCIATES
A CONSTRUCTION CONSULTING FIRM
100 DUFFY AVENUE, HICKSVILLE NY 11801
TEL: (516) 932-1010

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Franklin Avenue Shuttle

MTA/NYCT

July 25, 2019

BASIS OF ESTIMATE

1.0 ***Description of typical APG / PSD installation:***

1.1 *APGs will be 4'-6" foot high system cantilevered from the platform*
1.2 *APGs / PSDs will provide 7 emergency egress doors with push bars per platform*
1.3 *Each platform edge will have 10 cameras for CCTV coverage; cameras tied to a central control facility via existing fiber backbone*
1.4 *Control Rooms will be as documented in the individual reports; walls will be 8 inch CMU with glazed ceramic tile on exterior/public side of the walls (if located on below grade platform)*
1.5 *Control Rooms will serve both platform edges unless otherwise indicated*
1.6 *Control Rooms will be cooled to maintain operability of the control equipment*
1.7 *Due to entrapment concerns (someone being trapped between the train doors and the APGs / PSDs) a laser sensor gap detection system will be included at 100% of the doors to assure that doors are clear before the train leaves the station*
1.8 *Stray current isolation will be required be means of grounding wires and non-conductive paint on columns; assume (42) 10" x 10" H columns will be painted to 10 feet above the platform finish; assume a grounding wire to negative running rail will be installed at three locations along the platform edge*

1.9 *Provide a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.*

2.0 ***Assumptions:***

2.1 It is assumed that each train has 2 cars on this line
2.2 In respect of the APG option, all platforms will require structural rehabilitation to take the anticipated loads.
2.3 In respect of the PSD option, only platforms that have not been upgraded in the recent past will require platform edge replacement.
2.4 There are no special security requirements made necessary by installation of the APG system
2.5 It is assumed that all stations have adequate electrical power to satisfy the additional load required for the PSDs/APGs. In the event the power is inadequate, the electrical service would have to be upgraded at an additional cost.
2.6 This estimate does not provide for the replacement of Platform Edge Lighting
2.7 Premium cost for night time work is considered 50% of total labor cost

3.0 ***Exclusions - Costs not included in the estimate:***

VJ ASSOCIATES

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Franklin Avenue Shuttle

MTA/NYCT

July 25, 2019

BASIS OF ESTIMATE

3.1 Costs associated with construction of remote Control Rooms (at locations other than inside the station)

3.2 Costs associated with changes to train signals or systems
3.3 Costs associated with changes to the platform or the station to widen platforms locally to accommodate APGs along their entire length
3.4 Costs associated with NYCT State Of Good Repair improvements to the station
3.5 Costs associated with changes to stop signals that may be required to accommodate alternate train lengths.
3.6 For the purposes of this estimate it is assumed that there are no costs required to mitigate interference with police and emergency radio communications within the platform area due to the installation of APGs
3.7 Escalation Cost is not included; Anticipate at 5% per annum.
3.8 Costs associated with the removal of Asbestos-Containing Materials (ACM) are excluded from this estimate.
3.9 No provision has been included for the anticipated premium associate with tariffs on imported Structural Steel / Aluminium
3.10 NYCT project cost is not included
3.11 GO and flagging cost is not included
3.12 Maintenance / Operational Costs are not included. These will form part of a separate exercise

4.0 ***Below the line or "soft" costs:***

4.1 Design and Construction Contingency
4.2 Contractor O & P
4.3 Insurance
4.4 NYCT project costs not included

5.0 ***Additional Notes***

5.1 Given the limited time available, no drawings were developed to support this estimate.

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MTA /NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Franklin Avenue Shuttle
July 25, 2019

ORDER OF MAGNITUDE COSTS			MRN 139	MRN 141	MRN 142
DESCRIPTION			FRANKLIN AVE	PARK PLACE	BOTANIC GARDEN
1	AUTOMATIC PLATFORM GATES (APG'S)		$6,047,846	$6,013,248	$7,493,651
2	ADA ZONE		ADA COMPLIANT	ADA COMPLIANT	ADA COMPLIANT
3	ENVIRONMENTAL		Excl.	Excl.	Excl.
	TOTAL DIRECT COST		$6,047,846	$6,013,248	$7,493,651
4	GENERAL REQUIREMENTS	15.00%	$907,177	$901,987	$1,124,048
	SUB-TOTAL:		$6,955,023	$6,915,235	$8,617,699
5	ALLOWANCE FOR INDETERMINATES (AFI)	25.00%	$1,738,756	$1,728,809	$2,154,425
	SUB-TOTAL:		$8,693,779	$8,644,044	$10,772,124
6	OVERHEAD & PROFIT	15.00%	$1,304,067	$1,296,607	$1,615,819
	SUB-TOTAL:		$9,997,846	$9,940,651	$12,387,942
7	BONDS & INSURANCE	3.75%	$374,919	$372,774	$464,548
	SUB-TOTAL:		$10,372,765	$10,313,425	$12,852,490
	SUBTOTAL CONSTRUCTION COST W/O ACM		$10,372,765	$10,313,425	$12,852,490
8	ESCALATION TO CONSTRUCTION MID-POINT		Excl.	Excl.	Excl.
9	ACM ABATEMENT		BY OWNER	BY OWNER	BY OWNER
	SUBTOTAL CONSTRUCTION COST W/ ACM		$10,372,765	$10,313,425	$12,852,490
10	DESIGN CONSULTANT FEES	10.00%	$1,037,277	$1,031,343	$1,285,249
11	STATURORY ADA IMPROVEMENTS		Excl.	Excl.	Excl.
	TOTAL PROJECT COST (APG OPTION)		$11,410,042	$11,344,768	$14,137,739
	ADD ALTERNATIVES				
A	Additional cost associated with Platform Screen Doors [PSD's] in lieu of Automatic Platform Gates [APG's]		578,243	557,647	1,185,115
	Add for Markups (as above)	88.66%	512,687	494,426	1,050,757
	SUB-TOTAL PSD ALTERNATIVE		$1,090,929	$1,052,073	$2,235,872
	TOTAL PROJECT COST (PSD OPTION)		$12,500,971	$12,396,840	$16,373,611

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Franklin Avenue Shuttle

25-Jul-19

STATION : FRANKLIN AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	175	LF		
5	TOTAL LENGTH OF THE PLATFORM EDGE =	**175**	**LF**		
6	NUMBER OF TRAIN CARS ON THIS LINE =	**2**	**CARS**		
7					
8	**AUTOMATIC PLATFORM GATES [APG's]**				
9					
10	**Platform edge reconstruction**				
11	Demolition				
12	Remove existing polyethylene edge strip	175	LF	7	1,228
13	Remove 5' wide section of 3" deep structural slab to platform edge	877	SF	12	10,525
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	18	CY	2,500	45,000
16	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	177	EA	25	4,436
17	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	177	EA	25	4,436
18	Cast in assemblies for PSD holding down bolts	128	EA	180	23,040
19	Polyethylene edge strip	175	LF	95	16,665
20	Provide sleeves for HV & LV wires	72	EA	110	7,920
21					
22	**Platform edge finishes**				
23	Demolition				
24	Remove existing tactile warning strip 2' wide	175	LF	15	2,631
25	Remove existing platform tiles	175	LF	12	2,105
26	Sawcut existing topping concrete at perimeter of removal area	175	LF	5	877
27	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	1,053	SF	8	8,420
28	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-4" wide strip	253	SF	8	2,026
29	New Work				
30	New concrete topping to match existing	175	SF	15	2,631
31	New concrete topping at ADA boarding area to match existing	253	SF	15	3,798

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Franklin Avenue Shuttle

25-Jul-19

STATION : FRANKLIN AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
32	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	48	LF	110	5,280
33	Misc. patchwork	1	LS	50,000	50,000
34					
35	**Equipment Room [7'-0" x 27'-0"]**				
36	Build off existing mezzanine slab		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	41	LF	90	3,690
38	CMU Wall for equipment room	410	SF	45	18,450
39	Vertical connections with existing structure	20	LF	25	500
40	Roof for equipment room	189	SF	30	5,670
41	Fire rated door including frame & hardware	1	EA	2,500	2,500
42	Exterior wall finish				
43	Ceramic Tiling to match existing	410	SF	40	16,400
44	Mosaic Band to match existing - Assuming 8" high	41	LF	120	4,920
45	Concrete cove to match existing	41	LF	20	820
46	Interior Wall Finish - Paint	680	SF	5	3,400
47	Allow for Misc. floor & ceiling finishes	189	SF	15	2,835
48	Allow for 4" thick concrete pads for equipment	47	SF	20	945
49	Allowance for Mechanical Scope	1	LS	40,000	40,000
50	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
51	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
52	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
53					
54	**Automatic Platform Gates [APGs] - 4'-6" High**				
55	Automatic bi-parting gates; Assumed 6'-0" wide (2 Cars x 4 Doors = 8 No. per platform)	8	EA	15,000	120,000
56	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #7 per Platform	7	EA	10,500	73,500
57	Double egress/service gate in the center of the platform; #1 per Platform	1	EA	20,000	20,000
58	Platform End Gates (PEGs)	2	EA	13,000	26,000
59	Fixed Panels including framing and support; 4'-6" High	443	SF	750	332,168
60	Spare Parts - Approx. 10% of Material Cost	1	LS	34,300	34,300
61	Testing and commissioning	800	HRS	160	127,944
62	Product Warranty	1	LS	1,000,000	1,000,000
63	Allowance for Braille Signage	8	EA	2,500	20,000
64					
65	**Electrical**				
66	Electrical Upgrades				
67	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
68	Power and Lighting				
69	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
70	Allow for conduit / cable runs for power and communications under platform edge	175	LF	60	10,525

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Franklin Avenue Shuttle

25-Jul-19

STATION : FRANKLIN AVE

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	PSD Connections	1	LS	75,000	75,000
72	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
73	Power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
74	Reserve power to PSD Room from EDR [Conduit & Cable]	200	LF	60	12,000
75	No allowance for new lighting as if APG's are used		Note		EXCL.
76	Grounding				
77	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
78	MISC				
79	Testing and commissioning	1	EA	30,000	30,000
80	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
81					
82	**Communications**				
83	FA System				
84	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
85	CCTV coverage				
86	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	10	EA	12,000	120,000
87	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
88	Berthing Technology Sensors				
89	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	1	EA	16,000	16,000
90	Train Door Detection System				
91	Train Door Detection Sensor including software and hardware requirements	1	EA	15,000	15,000
92	Entrapment concerns				
93	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	24	EA	4,629	111,102
94	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	24	EA	5,566	133,574
95	Engineering and Testing	1,000	Hrs	160	159,930
96	Centralized monitoring/control				
97	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
98	MISC				
99	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
100	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
101	Site Survey and Inspections	1	LS	100,000	100,000
102	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Franklin Avenue Shuttle

25-Jul-19

STATION : FRANKLIN AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Furnish Test Equipment allowance	1	LS	500,000	500,000
104	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
105					
106	**Training**				
107	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
108					
109	**Out of hours Work**				
110	Allow loss of production to work at night say 50%	1	LS	1,395,657	1,395,657
111					
112	**TOTAL PSD WORK:**				**$ 6,047,846**
114					
115	ADD ALTERNATIVE				
116					
117	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
118					
119	ADD				
120	Automatic bi-parting doors (2 Cars x 4 Doors = 8 No. per platform)	8	EA	25,000	200,000
121	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #7 per Platform	7	EA	15,000	105,000
122	Double egress/service gate in the center of the platform; #1 per Platform	1	EA	30,000	30,000
123	Platform End Gates (PEGs)	2	EA	18,000	36,000
124	Fixed Panels including framing and support; Assuming 8'-0" high	890	SF	750	667,559
125	Spare Parts - Approx. 10% of Material Cost	1	LS	62,314	62,314
126	Structual framing / bracing				
127	HSS4x4x1/2 hanger	1	TONS	17,500	12,766
128	L6x6x1/2 continuous angle	1	TONS	17,500	22,594
129	Drilling and bolting - 4 bolts at each connection	70	EA	216	15,156
130	Platform Edge Repair				
131	Remove concrete platform edge				Previously done
132	Platform edge repair				Previously done
133	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
134	Signal Work [Each 300' length is associated with one signal light]				
135	Disconnects				Not Applicable
136	Remove signal cables				Not Applicable
137	Remove conduit; Assuming 1"				Not Applicable
138	Install conduit in new position				Not Applicable
139	Install replacement cable; assumed single cable #12				Not Applicable
140	Re-commission / testing as required				Not Applicable
141	Engineering / Shop Drawings / Etc.				Not Applicable
142	Premium Time				Not Applicable
143					
144	OMIT				

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Franklin Avenue Shuttle

25-Jul-19

STATION : FRANKLIN AVE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
145	Automatic bi-parting gates; Assumed 6'-0" wide (2 Cars x 4 Doors = 8 No. per platform)	(8)	EA	15,000	(120,000)
146	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #7 per Platform	(7)	EA	10,500	(73,500)
147	Double egress/service gate in the center of the platform; #1 per Platform	(1)	EA	20,000	(20,000)
148	Platform End Gates (PEGs)	(2)	EA	13,000	(26,000)
149	Fixed Panels including framing and support; 4'-6" High	(443)	SF	750	(332,168)
150	Spare Parts - Approx. 10% of Material Cost	(1)	LS	34,300	(34,300)
151	Platform Edge Reconstruction work	(1)	LS	87,436	(87,436)
152	Remove allowance for cast in sleeves for LV & HV power	(72)	EA	110	(7,920)
153	Conduit running under Platform Edge	(175)	LF	30	(5,263)
154					
155	Allow loss of production to work at night say 50%	1	LS	133,441	133,441
156					
157	**PREMIUM ASSOCIATED WITH PSD's**				**$ 578,243**

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Franklin Avenue Shuttle

25-Jul-19

STATION : PARK PLACE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	170	LF		
5	TOTAL LENGTH OF THE PLATFORM EDGE =	**170**	**LF**		
6	NUMBER OF TRAIN CARS ON THIS LINE =	**2**	**CARS**		
7					
8	**AUTOMATIC PLATFORM GATES [APG's]**				
9					
10	**Platform edge reconstruction**				
11	Demolition				
12	Remove existing polyethylene edge strip	170	LF	7	1,190
13	Remove 5' wide section of 3" deep structural slab to platform edge	850	SF	12	10,200
14	New Work				
15	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	18	CY	2,500	45,000
16	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	172	EA	25	4,300
17	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	172	EA	25	4,300
18	Cast in assemblies for PSD holding down bolts	128	EA	180	23,040
19	Polyethylene edge strip	170	LF	95	16,150
20	Provide sleeves for HV & LV wires	72	EA	110	7,920
21					
22	**Platform edge finishes**				
23	Demolition				
24	Remove existing tactile warning strip 2' wide	170	LF	15	2,550
25	Remove existing platform tiles	170	LF	12	2,040
26	Sawcut existing topping concrete at perimeter of removal area	170	LF	5	850
27	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	1,020	SF	8	8,160
28	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance of platform width i.e. 12'-4" wide strip	253	SF	8	2,026
29	New Work				
30	New concrete topping to match existing	170	SF	15	2,550
31	New concrete topping at ADA boarding area to match existing	253	SF	15	3,798

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Franklin Avenue Shuttle

25-Jul-19

STATION : PARK PLACE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	48	LF	110	5,280
33	Misc. patchwork	1	LS	50,000	50,000
34					
35	**Equipment Room [7'-0" x 27'-6"]**				
36	Build off existing platform slab		Note		
37	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
38	CMU Wall for equipment room	415	SF	45	18,675
39	Vertical connections with existing structure	20	LF	25	500
40	Roof for equipment room	193	SF	30	5,775
41	Fire rated door including frame & hardware	1	EA	2,500	2,500
42	Exterior wall finish				
43	Ceramic Tiling to match existing	415	SF	40	16,600
44	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
45	Concrete cove to match existing	42	LF	20	830
46	Interior Wall Finish - Paint	690	SF	5	3,450
47	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
48	Allow for 4" thick concrete pads for equipment	48	SF	20	963
49	Allowance for Mechanical Scope	1	LS	40,000	40,000
50	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
51	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
52	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
53					
54	**Automatic Platform Gates [APGs] - 4'-6" High**				
55	Automatic bi-parting gates; Assumed 6'-0" wide (2 Cars x 4 Doors = 8 No. per platform)	8	EA	15,000	120,000
56	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #7 per Platform	7	EA	10,500	73,500
57	Double egress/service gate in the center of the platform; #1 per Platform	1	EA	20,000	20,000
58	Platform End Gates (PEGs)	2	EA	13,000	26,000
59	Fixed Panels including framing and support; 4'-6" High	419	SF	750	313,875
60	Spare Parts - Approx. 10% of Material Cost	1	LS	33,203	33,203
61	Testing and commissioning	800	HRS	160	127,944
62	Product Warranty	1	LS	1,000,000	1,000,000
63	Allowance for Braille Signage	8	EA	2,500	20,000
64					
65	**Electrical**				
66	Electrical Upgrades				
67	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
68	Power and Lighting				
69	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000
70	Allow for conduit / cable runs for power and communications under platform edge	170	LF	60	10,200

MTA/NYCT

Tier 2-3 Report on Feasibility of Platform Edge Barriers for Franklin Avenue Shuttle

25-Jul-19

STATION : PARK PLACE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	PSD Connections	1	LS	75,000	75,000
72	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
73	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
74	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
75	No allowance for new lighting as if APG's are used		Note		EXCL.
76	Grounding				
77	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
78	MISC				
79	Testing and commissioning	1	EA	30,000	30,000
80	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
81					
82	**Communications**				
83	FA System				
84	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
85	CCTV coverage				
86	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	10	EA	12,000	120,000
87	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
88	Berthing Technology Sensors				
89	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	1	EA	16,000	16,000
90	Train Door Detection System				
91	Train Door Detection Sensor including software and hardware requirements	1	EA	15,000	15,000
92	Entrapment concerns				
93	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	24	EA	4,629	111,102
94	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	24	EA	5,566	133,574
95	Engineering and Testing	1,000	Hrs	160	159,930
96	Centralized monitoring/control				
97	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
98	MISC				
99	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
100	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000
101	Site Survey and Inspections	1	LS	100,000	100,000
102	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Franklin Avenue Shuttle

25-Jul-19

STATION : PARK PLACE

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
103	Furnish Test Equipment allowance	1	LS	500,000	500,000
104	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
105					
106	**Training**				
107	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
108					
109	**Out of hours Work**				
110	Allow loss of production to work at night say 50%	1	LS	1,387,673	1,387,673
111					
112	**TOTAL PSD WORK:**				**$ 6,013,248**
114					
115	ADD ALTERNATIVE				
116					
117	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
118					
119	ADD				
120	Automatic bi-parting doors (2 Cars x 4 Doors = 8 No. per platform)	8	EA	25,000	200,000
121	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #7 per Platform	7	EA	15,000	105,000
122	Double egress/service gate in the center of the platform; #1 per Platform	1	EA	30,000	30,000
123	Platform End Gates (PEGs)	2	EA	18,000	36,000
124	Fixed Panels including framing and support; Assuming 8'-0" high	847	SF	750	635,039
125	Spare Parts - Approx. 10% of Material Cost	1	LS	60,362	60,362
126	Structual framing / bracing				
127	HSS4x4x1/2 hanger	1	TONS	17,500	12,412
128	L6x6x1/2 continuous angle	1	TONS	17,500	21,896
129	Drilling and bolting - 4 bolts at each connection	68	EA	216	14,688
130	Platform Edge Repair				
131	Remove concrete platform edge				Previously done
132	Platform edge repair				Previously done
133	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
134	Signal Work [Each 300' length is associated with one signal light]				
135	Disconnects				Not Applicable
136	Remove signal cables				Not Applicable
137	Remove conduit; Assuming 1"				Not Applicable
138	Install conduit in new position				Not Applicable
139	Install replacement cable; assumed single cable #12				Not Applicable
140	Re-commission / testing as required				Not Applicable
141	Engineering / Shop Drawings / Etc.				Not Applicable
142	Premium Time				Not Applicable
143					
144	OMIT				

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Franklin Avenue Shuttle

25-Jul-19

STATION : PARK PLACE

ITEM	DESCRIPTION OF WORK	UNIT QTY	MEAS	UNIT COST	TOTAL STATION COST
145	Automatic bi-parting gates; Assumed 6'-0" wide (2 Cars x 4 Doors = 8 No. per platform)	(8)	EA	15,000	(120,000)
146	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #7 per Platform	(7)	EA	10,500	(73,500)
147	Double egress/service gate in the center of the platform; #1 per Platform	(1)	EA	20,000	(20,000)
148	Platform End Gates (PEGs)	(2)	EA	13,000	(26,000)
149	Fixed Panels including framing and support; 4'-6" High	(419)	SF	750	(313,875)
150	Spare Parts - Approx. 10% of Material Cost	(1)	LS	33,203	(33,203)
151	Platform Edge Reconstruction work	(1)	LS	86,840	(86,840)
152	Remove allowance for cast in sleeves for LV & HV power	(72)	EA	110	(7,920)
153	Conduit running under Platform Edge	(170)	LF	30	(5,100)
154					
155	Allow loss of production to work at night say 50%	1	LS	128,688	128,688
156					
157	**PREMIUM ASSOCIATED WITH PSD's**				**$ 557,647**

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Tier 2-3 Report on Feasibility of Platform Edge Barriers for Franklin Avenue Shuttle

25-Jul-19

STATION : BOTANIC GARDEN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
1	**GENERAL NOTES**				
2	The estimate detail (lines 1 through 150 below) lists the components of the Platform Screen Door installation with a description of each item, a Quantity, a Unit of Measure, a Unit Cost and a Total Station Cost. The Station Cost represents the cost of PSD's and associated ancillary scope to two platform edges and a single control room.				
3	On the Summary (Page 4) the total of the estimated detail line items below appears as the Total Direct Cost at the top of the page. After adding general requirements, overhead & profit, bonds & insurance the construction cost is given. After adding design fees, the Project Cost for this Station and other stations studied is given. The summary page also contains an Alternative Option Premiums for the Platform Screen Doors in lieu of the APG's.				
4	LENGTH OF THE PLATFORM EDGE =	174	LF		
5	LENGTH OF THE PLATFORM EDGE =	174	LF		
6	TOTAL LENGTH OF THE PLATFORM EDGE =	**347**	**LF**		
7	NUMBER OF TRAIN CARS ON THIS LINE =	**2**	**CARS**		
8					
9	**AUTOMATIC PLATFORM GATES [APG's]**				
10					
11	**Platform edge reconstruction**				
12	Demolition				
13	Remove existing polyethylene edge strip	347	LF	7	2,431
14	Remove 5' wide section of 3" deep structural slab to platform edge	1,737	SF	12	20,840
15	New Work				
16	Cast in place platform edge slab; Approx. 5'-0" wide x 6" minimum depth at cantilever edge	35	CY	2,500	87,500
17	Drill and adhere dowel to existing concrete wall [at platform edge]; #4 Dowel w/standard hook @ 12" O.C; 6" Embed	349	EA	25	8,734
18	Drill and adhere dowel to existing concrete structural slab; #4 Dowel w/standard hook @ 12" O.C	349	EA	25	8,734
19	Cast in assemblies for PSD holding down bolts	128	EA	180	23,040
20	Polyethylene edge strip	347	LF	95	32,997
21	Provide sleeves for HV & LV wires	72	EA	110	7,920
22					
23	**Platform edge finishes**				
24	Demolition				
25	Remove existing tactile warning strip 2' wide	347	LF	15	5,210
26	Remove existing platform tiles	347	LF	12	4,168
27	Sawcut existing topping concrete at perimeter of removal area	347	LF	5	1,737
28	Remove existing 3" concrete topping for platform edge re-construction; Assuming 6' wide strip	2,084	SF	8	16,672
29	Remove existing 3" concrete topping at 40' long ADA boarding area; Balance Platform width i.e. 7'-9" wide	140	SF	8	1,120
30	New Work				
31	New concrete topping to match existing	347	SF	15	5,210

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25-Jul-19

STATION : BOTANIC GARDEN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
32	New concrete topping at ADA boarding area to match existing	140	SF	15	2,100
33	Tactile Warning Strip - 2' wide strip along platform edge at door openings only & Platform end gates	96	LF	110	10,560
34	Misc. patchwork	1	LS	50,000	50,000
35					
36	**Equipment Room [7'-0" x 27'-6"]**				
37	Build off existing platform slab		Note		
38	Form 8" wide concrete curb including dowelling to platform slab	42	LF	90	3,735
39	CMU Wall for equipment room	415	SF	45	18,675
40	Vertical connections with existing structure	20	LF	25	500
41	Roof for equipment room	193	SF	30	5,775
42	Fire rated door including frame & hardware	1	EA	2,500	2,500
43	Exterior wall finish				
44	Ceramic Tiling to match existing	415	SF	40	16,600
45	Mosaic Band to match existing - Assuming 8" high	42	LF	120	4,980
46	Concrete cove to match existing	42	LF	20	830
47	Interior Wall Finish - Paint	690	SF	5	3,450
48	Allow for Misc. floor & ceiling finishes	193	SF	15	2,888
49	Allow for 4" thick concrete pads for equipment	48	SF	20	963
50	Allowance for Mechanical Scope	1	LS	40,000	40,000
51	Allow for trench drains including associated pipework, cutting & patching, etc.	1	LS	60,000	60,000
52	Allow for Inergen Fire Suppression System incl. tanks, manifold, piping, discharge nozzles, signage, link to FA System	1	LS	100,000	100,000
53	Allowance to bring fiber optic to Control Room from network node	1	LS	15,000	15,000
54					
55	**Automatic Platform Gates [APGs] - 4'-6" High**				
56	Automatic bi-parting gates; Assumed 6'-0" wide (2 Cars x 4 Doors = 8 No. per platform)	16	EA	15,000	240,000
57	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #7 per Platform	14	EA	10,500	147,000
58	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	20,000	40,000
59	Platform End Gates (PEGs)	4	EA	13,000	52,000
60	Fixed Panels including framing and support; 4'-6" High	870	SF	750	652,523
61	Spare Parts - Approx. 10% of Material Cost	1	LS	67,891	67,891
62	Testing and commissioning	800	HRS	160	127,944
63	Product Warranty	1	LS	1,000,000	1,000,000
64	Allowance for Braille Signage	16	EA	2,500	40,000
65					
66	**Electrical**				
67	Electrical Upgrades				
68	Assumed adequate power is available to cater for additional load required by above scope		Note		EXCL.
69	Power and Lighting				
70	Allowance for Circuit Breakers,Panels, UPS's in connection with PSD's	1	LS	200,000	200,000

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25-Jul-19

STATION : BOTANIC GARDEN

ITEM	DESCRIPTION OF WORK	UNIT QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
71	Allow for conduit / cable runs for power and communications under platform edge	347	LF	60	20,840
72	PSD Connections	1	LS	75,000	75,000
73	Allowance for Electrical / Comms Work inside Control Room including Panels, etc.	1	EA	200,000	200,000
74	Power to PSD Room from EDR [Conduit & Cable]	100	LF	60	6,000
75	Reserve power to PSD Room from EDR [Conduit & Cable]	150	LF	60	9,000
76	No allowance for new lighting as if APG's are used, it is not expected to be an issue.		Note		EXCL.
77	Grounding				
78	Allowance for new grounding wiring for structural steel and new sensors throughout station	1	EA	25,000	25,000
79	MISC				
80	Testing and commissioning	1	EA	30,000	30,000
81	As Built, Shop Drwgs, Permits and approvals	1	LS	30,000	30,000
82					
83	**Communications**				
84	FA System				
85	Scope in connection with Fire Alarm System	1	LS	100,000	100,000
86	CCTV coverage				
87	CCTV Camera System [#1 per Door & additional #1 per Car]; including access nodes, panels, wiring, conduit, etc.	20	EA	12,000	240,000
88	CCTV Network Rack (w/ IE-5000, Fire Wall, Server, KVM, Net guard, PDU), Application Fiber Distribution Panel (AFDP)	1	LS	100,000	100,000
89	Berthing Technology Sensors				
90	Allowance for Berthing Technology for Control Train Berthing including software and hardware requirements	2	EA	16,000	32,000
91	Train Door Detection System				
92	Train Door Detection Sensor including software and hardware requirements	2	EA	15,000	30,000
93	Entrapment concerns				
94	Sick LMS100-10000 laser scanner [Allowance of 3 per opening]; including specialist sub-contractor mark-up	48	EA	4,629	222,204
95	Allowance for labor in mounting to the roof, the convertor boxes, the Ethernet+power wiring and the PSD room equipment.	48	EA	5,566	267,147
96	Engineering and Testing	1,000	Hrs	160	159,930
97	Centralized monitoring/control				
98	Allowance for the provision of a network/system for centralized monitoring/control of door operations at the RCC. Communication with this system will be via the current Sonet/ATM (SACNS) or COE network potentially leveraging the existing PSLAN. The set-up of the head-end for such a system is a one-time cost, integration cost would be per station.	1	LS	70,000	70,000
99	MISC				
100	Penetration, patching, selective demo and minor modifications	1	LS	25,000	25,000
101	Testing and commissioning (Except Entrapment, Berthing, TDDS)	1	LS	40,000	40,000

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25-Jul-19

STATION : BOTANIC GARDEN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
102	Site Survey and Inspections	1	LS	100,000	100,000
103	Allowance for FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing)	1	LS	150,000	150,000
104	Furnish Test Equipment allowance	1	LS	500,000	500,000
105	As Built, Shop Drwgs, Permits and approvals	1	LS	50,000	50,000
106					
107	**Training**				
108	Allowance for training NYCT Staff - Nominal Allowance [Assuming majority of training is catered for in the Pilot Project]	1	LS	150,000	150,000
109					
110	**Out of hours Work**				
111	Allow loss of production to work at night say 50%	1	LS	1,729,304	1,729,304
112					
113	**TOTAL PSD WORK:**				**$ 7,493,651**
115					
116	ADD ALTERNATIVE				
117					
118	OPTION FOR PLATFORM SCREEN DOORS [PSDS]				
119					
120	ADD				
121	Automatic bi-parting doors (2 Cars x 4 Doors = 8 No. per platform)	16	EA	25,000	400,000
122	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #7 per Platform	14	EA	15,000	210,000
123	Double egress/service gate in the center of the platform; #1 per Platform	2	EA	30,000	60,000
124	Platform End Gates (PEGs)	4	EA	18,000	72,000
125	Fixed Panels including framing and support; Assuming 8'-0" high	1,752	SF	750	1,314,117
126	Spare Parts - Approx. 10% of Material Cost	1	LS	123,367	123,367
127	Structual framing / bracing				
128	HSS4x4x1/2 hanger	1	TONS	17,500	23,997
129	L6x6x1/2 continuous angle	3	TONS	17,500	44,737
130	Drilling and bolting - 4 bolts at each connection	139	EA	216	30,010
131	Platform Edge Repair				
132	Remove concrete platform edge				Previously done
133	Platform edge repair				Previously done
134	Drilling and cast in place treaded bar for receiving base plates for PSD framing; #4 per base plate				Previously done
135	Signal Work [Each 300' length is associated with one signal light]				
136	Disconnects				Not Applicable
137	Remove signal cables				Not Applicable
138	Remove conduit; Assuming 1"				Not Applicable
139	Install conduit in new position				Not Applicable
140	Install replacement cable; assumed single cable #12				Not Applicable
141	Re-commission / testing as required				Not Applicable
142	Engineering / Shop Drawings / Etc.				Not Applicable
143	Premium Time				Not Applicable

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25-Jul-19

STATION : BOTANIC GARDEN

ITEM	DESCRIPTION OF WORK	QTY	UNIT MEAS	UNIT COST	TOTAL STATION COST
144					
145	OMIT				
146	Automatic bi-parting gates; Assumed 6'-0" wide (2 Cars x 4 Doors = 8 No. per platform)	(16)	EA	15,000	(240,000)
147	Hinged Emergency Escape Gates (EEGs) - Between the bi-parting doors; #7 per Platform	(14)	EA	10,500	(147,000)
148	Double egress/service gate in the center of the platform; #1 per Platform	(2)	EA	20,000	(40,000)
149	Platform End Gates (PEGs)	(4)	EA	13,000	(52,000)
150	Fixed Panels including framing and support; 4'-6" High	(870)	SF	750	(652,523)
151	Spare Parts - Approx. 10% of Material Cost	(1)	LS	67,891	(67,891)
152	Platform Edge Reconstruction work	(1)	LS	148,847	(148,847)
153	Remove allowance for cast in sleeves for LV & HV power	(72)	EA	110	(7,920)
154	Conduit running under Platform Edge	(347)	LF	30	(10,420)
155					
156	Allow loss of production to work at night say 50%	1	LS	273,488	273,488
157					
158	PREMIUM ASSOCIATED WITH PSD's				$ 1,185,115